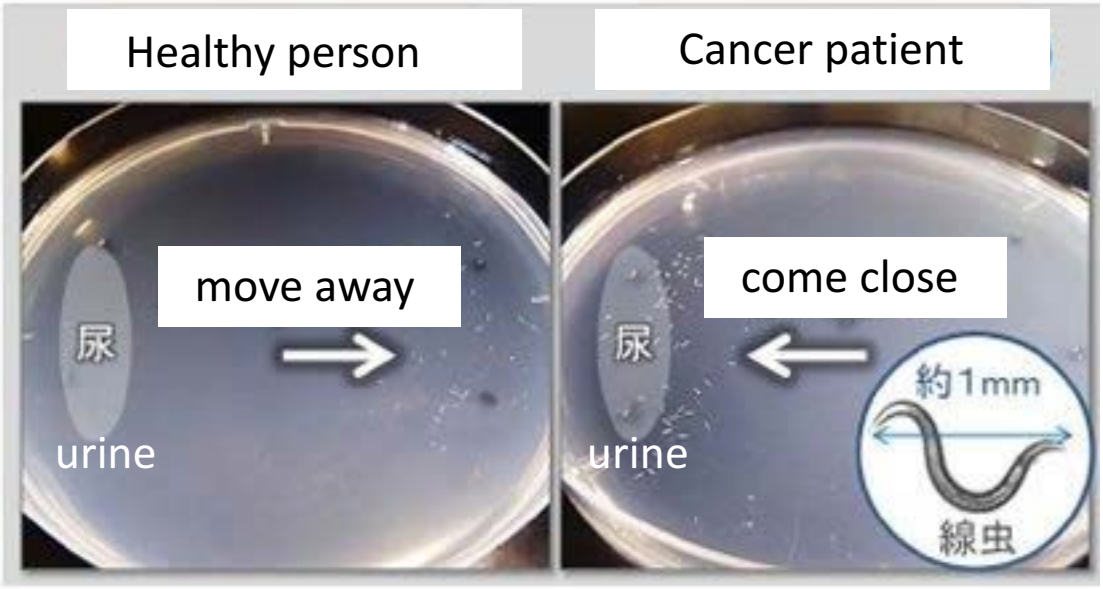
The Story Behind the Development of N-NOSE
The nematode cancer screening test transforming the field of oncology

TECHNOLOGY

2017.10.17 Tue.　Hiromi Kihara（Medical Journalist）

Just one drop of urine. Nematodes (roundworms) can distinguish the smell of cancer in a sample size this small. Just as amazingly, the impressive accuracy rate is 95% or higher, which holds great prospects for early-stage detection. N-NOSE is the name of this test, which uses nematodes and has created much fanfare in Japan. We wanted to find the impressive story behind N-NOSE, particularly in this day and age of unending successions of low-quality imitation products. N-NOSE's developer is Dr. Takaaki Hirotsu, with Hitachi, Ltd. developing the automated analyzer and Nanpuh Hospital collaborating with clinical trials. We approached this grand project from a third-person perspective, examining its possibilities for changing the circumstances and status quo of cancer.
(HEALTHCARE Biz Editorial Department)



Nematode
about 1 mm

Detect Cancer through a Urine Test,
Finish Treatment the Following Week!

In the near future, autumn of 20XX, less than 10 years from now.

Ms. A (43 years old) tests positive for cancer through a urine test administered at a hospital.
The test's name is N-NOSE and it uses the abilities of nematodes to detect abnormalities in a cancer patient's urine, with 95% or great accuracy.[*1] By examining a single drop of urine, the test detects the presence of stage 0 cancer (an extremely early stage of the disease).
Furthermore, the inexpensive test costs only a few thousand yen (equivalent to approx. US$20) per exam.[*2]

Ah, that explains it. Since coming onto the market in January of 2020, the test spread amazingly fast, so much so that more than 60%[*3] of citizens in their 40s and above (the demographic said to be at "cancer age"), and nearly 100% of those in their 40s and 50s (their prime working years), receive N-NOSE once a year.
Corporations and local municipalities have offered assistance so that, in some areas, the screening is mandatory.
Ms. A has received the screening every year for the past several years as part of her company's annual health check.

Presenting the results, her physician said the following:

"The test is positive, which means it is a near certainty that there is cancer in your body. However, since the screening was negative one year ago, even if there is cancer, it likely to be in an early stage, so you need not worry too much. In order to pinpoint the type of cancer, let me take a blood sample today. Under the screening law developed by the National Cancer Center in 2018, the cost is 20,000 yen [approx. US$200], but with a single drop of blood, we can detect 13 different types of cancer with about 95% accuracy. You will know the results next week.
As soon as we have that information, we can start treatment right away."

Accepting the explanation with a matter-of-fact attitude, Ms. A heads home. She feels that "having cancer inside her body" is bizarre, but not especially unsettling. After all, for the past few years, Ms. A's recollection is of hearing only about people "having cancer detected through urinalysis, but having a quick recovery due to the early stage of the disease" and she does not remember hearing of any cases around her where people stayed in the hospital or had surgery, and certainly none of anyone dying.

There were no apparent symptoms and she felt that cancer had become a disease little more worrisome than influenza.

A week later, her results indicated colon cancer.

The following day, she promptly received endoscopic surgery at the Gastrointestinal Center and all of the cancer, which was at stage 0, was removed in a few minutes. She later received the N-NOSE exam again, which confirmed that the cancer was gone, and Ms. A's "battle with cancer" was over in just two weeks.

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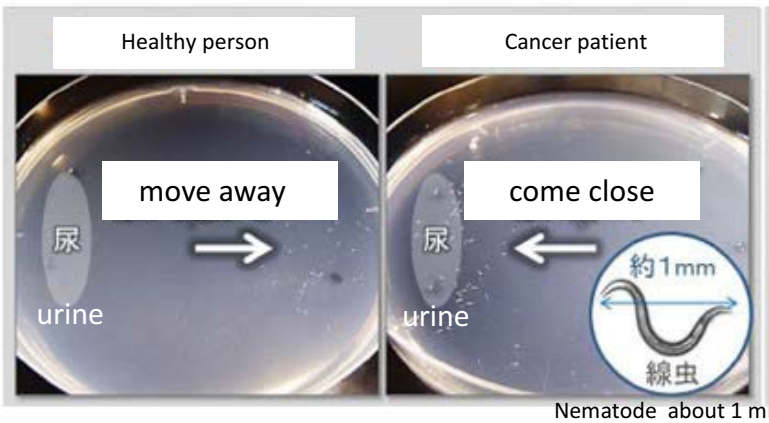
——— Although this is a hypothetical scenario set in the near future, the N-NOSE test mentioned, as well as the "cancer test from a single drop of blood," are, as of October 2017, nearing commercial viability within the next few years. In other words, the scenario is quite close to being non-fiction.

*1 According to references provided by Hirotsu Bio Science Inc., current as of September 2017
*2 An estimated price derived from preliminary calculations
*3 Currently 30-40% Japan is engaging in education and awareness activities, aiming for 50%.

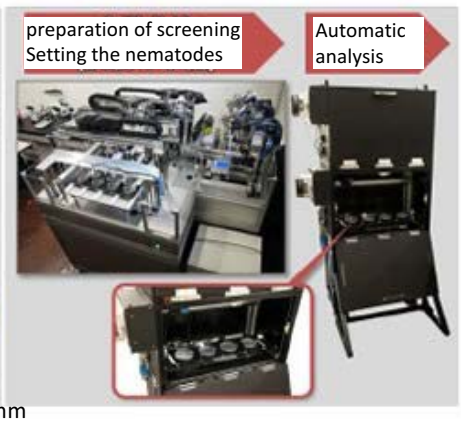
Overpowering odors do not suit them
A cleansing protocol is needed before work

Let's explain N-NOSE from the beginning
Its signature feature is the use of organisms called nematodes.



Nematode about 1 mm

N-Nose, Hirotsu Bio Science



Automatic Analyzer, Hitachi and Hirotsu Bio Science developed.

Nematodes are also named *c. elegans*. The appellation "elegans" originates from the "elegant" manner in which they move.
From the name, one gets a sense of researchers' fondness for the creatures.

Profile of (wild) nematodes
*Their length is approx. 1 mm and their color is transparent. Though visible to the naked eye, they are so small that they look more like powder.
*At a temperature of 23º, they move about energetically. At temperatures above or below this point, their movement becomes lethargic. They are surprisingly delicate.
*Under optimal circumstances, they will move across the petri dish from the left toward the area with the urine in about 10 minutes.
*They are fond of E. coli. E. coli is given as food to cultivate them in an agar medium. Consequently, their feed is extremely inexpensive.
*Their forte is detecting the presence (or absence) of cancer due to being drawn toward the urine of cancer patients and having the tendency to avoid the urine of healthy patients.
*They have an excellent sense of smell. They possess three times the smell receptors of humans and 1,200 more smell receptors than dogs.
*However, they respond poorly to overpowering odors. Unless the urine is diluted, they will not approach it.
*Their lifespan is approx. 20 days. The number of days after hatching when their sense of smell is keenest is a trade secret.
*Since they are hermaphroditic, they do not need to be paired for mating. Nematodes are easy to breed!
*They can be kept frozen. Stocks can be stored semi-permanently.
*When it comes time to use them for screening, you rinse them. It is a so-called "cleansing" or "purification" process. If the E. coli that they like to eat is not rinsed away, they will not react to a cancer patient's urine.
Since they are living organisms, it is important to monitor their health and maintain a stable environment so that they will do their job. To mechanize the process, the development team was more challenged to reproduce technicians' lab techniques than to make the process faster.

The screening method will be detailed in the section below. The mechanization and automation process had to be carefully based on the steps that humans carry out by hand and the screening robot had to be delicate enough not to stress the nematodes.

This N-NOSE test uses the capabilities of living organisms to detect cancer and offers the following merits not available in conventional testing methods.

(1) It is painless --> only one drop of urine is required.

(2) It is simple --> no special conditions are needed during the urine collection. For example, there are no pre-test dietary restrictions, etc. the day before.

(3) It is fast --> when performed by hand, test results are available in approx. one hour. Once fully automated, the test will be even faster and will be able to yield results for multiple samples at once.

(4) It is inexpensive --> aside from personnel, the only costs are agar and E. coli. It is far less expensive in comparison to PET-CT and other medical devices. Once automated, the cost will come down even further. Since the cost of introducing the test is low, it will also be within reach for developing countries.

(5) It can detect various types of cancer in one test --> which makes it well suited for cancer screening.
[Types of cancer detectable through the response of nematodes]
Stomach cancer, colorectal cancer, pancreatic cancer, esophageal cancer, gallbladder cancer, biliary tract cancer, prostate cancer, breast cancer, lung cancer, cecal cancer.

(6) Detection is possible at early stages --> nematodes respond to the urine of cancer patients even at stage 0 and stage 1.

(7) High sensitivity --> conventional tumor markers have low sensitivity to early-stage cancer and only detect more advanced cancer, while N-NOSE has the same sensitivity even for early-stage cancer.

Interview with Dr. Takaaki Hirotsu
During development, the perspective of a biological scientist proved invaluable

Hirotsu Bio Science
CEO
Takaaki Hirosu

So, what type of individual is the developer behind N-NOSE and the company, Hirotsu Bio Science Inc., working to commercialize the test? His name is Dr. Takaaki Hirotsu.

Dr. Hirotsu got his start as a biologist. He is a first-rate researcher who has studied nematodes' sense of smell for more than 20 years at the University of Tokyo and other institutions, and has published articles in the prestigious journals Nature and Science.

11 years ago, he was invited as a professor to Kyushu University, where he worked on joint research with fellow professor Hideto Sonoda. They discovered that nematodes had the ability to detect stage 0 cancer, which is typically difficult to detect with standard testing, from only one drop of urine. The announcement of their research in 2015 stunned the world.

Initially, Dr. Sonoda was studying early cancer detection using dogs' sense of smell. However, there is individual variation among dogs in this regard and he abandoned the approach due to difficulties, including obstacles for consistent analysis of large volumes of samples.
His attention next turned to nematodes. He explained the story that has now gained legendary status, "I was performing endoscopic treatment on an elderly patient who had contracted stomach Anisakis parasites from eating raw mackerel. I saw how the parasites (a type of nematode) were attracted to early-stage stomach cancer and hit on the idea of using them to detect early-stage cancer." (Some researchers have expressed doubts as to whether Anisakis was truly latching onto stomach cancer in this patient.)

Meanwhile, Dr. Hirotsu was researching nematodes. He explained, "I was doing more research on analyzing nematodes' sense of smell than anyone else in the world at that time."

Nematodes were being widely used in scientific experiments because they were not only easy to handle, but could also be propagated in large numbers. They had an excellent sense of smell that was said to be a million times that of humans. To make up for not having eyes, they used this keen olfactory power to detect and approach the location of food. Dr. Hirotsu had researched nematodes' sense of smell for more than 20 years and believe that this capability could bring some contribution to society and have business prospects as well, so he turned his attention toward the particular odor of cancer. Knowing that dogs exposed to the odor of cancer were able to detect the presence of the disease, he predicted that nematodes would be able to do so as well and approached Dr. Sonoda about joint research.

In the immediately ensuing experiments, human urine was placed on the left side of a laboratory dish. Then, they observed the reaction of 50-100 nematodes placed in the center of the dish. The results were just as expected. When the urine came from cancer patients, the nematodes crawled to the left side of the dish in about 30 minutes, while they stayed away from the urine of healthy patients.

"Some sort of substance released by cancer cells is in the urine. The nematodes smell this and approach it thinking it to be food," explained Dr. Hirotsu, noting that the nature of the substance has not yet been explicated. The substance that the nematodes are distinguishing by smell is so minute that it is not detected by world-class analyzing devices.

Dr. Hirotsu also noted, incidentally, that being an expert in nematode research was arguably an indispensable factor in the development of N-NOSE.

"For example, it would be ideal if you could use normally collected urine in the lab dish and have nematodes crawl towards it. However, the process is not so simple. If you used unaltered urine, the nematodes would ignore it.
The sample must be diluted just the right amount.

Yet most researcher probably assume that the urine needs to be concentrated, since the cancer aroma factors are so incredibly minute.
I diluted the sample instead. I knew from prior research that nematodes' affinity for certain smells shifted based on different concentrations. Humans, too, react well to an appropriate amount of perfume, for example, while feeling uncomfortable when the fragrance is too strong. Nematodes are the same.

In earlier textbooks, it said that nematodes' affinity, or lack of affinity, for a smell was unrelated to the smell's concentration. But this is incorrect. Being aware of this mechanism, I knew to immediately try diluting the urine when nematodes avoided an unaltered sample. That turned out to be the key to success. The development of N-NOSE rested on the expertise gained through basic research up to that point. Without that prior experience, the test may not have ever come about."

Hearing from Hitachi Researchers Struggling to Replace Human Procedures with a Machine

Masakazu Sugaya
Unit Leader & Lead Technical Instructor, Planning Office & Precision Prototype Development Center
Hitachi Central Research Facility (automated analytic devices)

"For example, there are 60 million people in Japan today who should receive cancer screening. What is called "cancer age" is 40 years old and above for men, and probably slightly younger for women. If we perform a rough calculation of how many technicians would be needed to process, by hand, one test per year by this number of people, we see that 50,000 staff would need to be hired. Of course, that's not likely possible."

"On top of that, the analysis needs to be done by specialized technicians, so the personnel costs quickly balloon.
It is not an option to do initial screening by hand, so we need to automate the process somehow.
Hitachi was brought onto this project for its strength in medical device development and due to the need to create an apparatus to handle this task that would be laborious for humans, would require close concentration, and would be tedious without a machine."

Hitachi Ltd. developed an automated Nematode Cancer Screening Device in two parts.
First, a loading apparatus collects the nematodes from the propagation medium, cleanses them, and places about 50-100 of them on plates with urine samples. Then, the second apparatus detects and automatically analyzes the nematodes' movement with respect to the urine. The plate is photographed and the number of nematodes is translated into data based on the amount of light (the brightness) so that counting does not have to be carried out with the naked eye. The device allows a quantitative evaluation of the nematode reaction and an automated assessment of taxis (movement) test results. Additionally, continuous photographs detect the degree to which the nematodes move in order to check that the conditions match those needed for reliable nematode screening. If the nematodes are lethargic, they are replaced and the test is run again.

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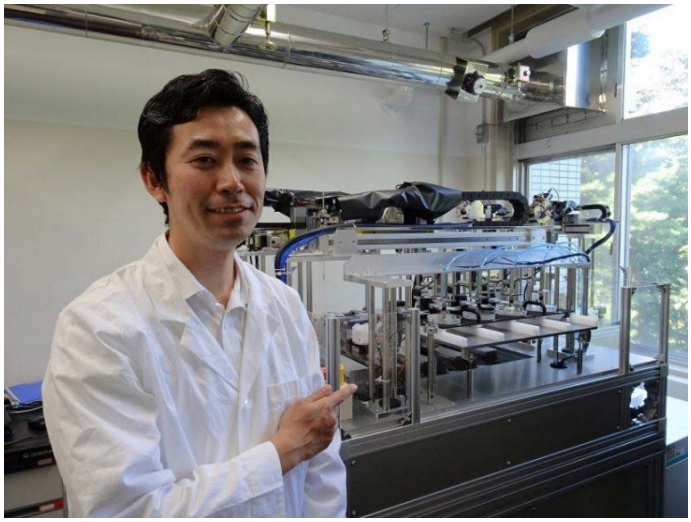

Taku Nakamura
Planning Office & Precision Prototype Development Center Hitachi Central Research Facility (automated analytic devices)

In order to ask about the difficulties surrounding techniques and interdisciplinary collaboration unique to "live organism diagnostics" using nematodes, we interviewed Masakazu Sugaya and Taku Nakamura of the Hitachi Central Research Facility where the prototype was created.

—— Isn't it quite unusual to automate a test that uses live organisms?

"As far as we know, this is the only attempt of this kind." (Sugaya)

—— Did it have you stumped at all?

"To be honest, we were a bit stumped from the beginning. In trying to quantify the data (which means taking something that is generally only expressed in qualitative terms and translating that into numerical expressions), we did not even know what to quantify.

So, we started by interviewing the technicians performing the tests by hand, but this did not solve the conundrum. We finally started to understand what to do by experimenting with plotting the nematodes on a dish and photographing what happens in order to know what information is being giving. We examined the pictures with researchers and repeatedly asked at each step, "Why are the nematodes moving in this way?" It took quite a lot of time." (Sugaya)

"For the lab technicians, there are steps that they do unconsciously and that they consider absolutely unremarkable. So, when we asked them how they did something, they could only reply with, 'We just did it as we normally would.' (chuckles) So, we had to stop them at every step of their "normal tasks" and continually ask, "Why did you just do that?" This was the only way that we could start to understand the process on our end." (Nakamura)

Readers hopefully can get a sense of how trying it was to persevere and arrive at a deep understanding.

"For technicians like us with an engineering background, there are many terms used in biology and similar fields that we do not know. One example is the difference between disinfection and sterilization. When told that we have to follow a sterilization protocol, we wondered what that means exactly. How is it different from disinfection and at what level is disinfection sufficient? It was quite a learning process for us." (Sugaya)

—— It seems that "cleansing" the nematodes would also be complicated. How do you wash such tiny organisms?

"Well, it's more like rinsing than washing. If we put the nematodes in small tubes and pour in buffering solution, the nematodes rise and fall. Then, if we skim off the top layer, we can pour in new fluid and keep repeating those steps to reproduce the process normally done by hand.

For lab technicians, they unconsciously perform the rinsing to a degree that does not harm the nematodes. For a machine, however, we had to numerically specify the rinsing speed, the angle at which the container is shaken, and the timing of changing the buffering solution. This was where watching video of the procedure done by hand allowed us to measure the timing and amount of fluid, the speed of shaking, etc., which we could repeat many times to arrive at optimal specifications." (Sugaya)

"The rinsing process also includes a variety of delicate movements, so it was difficult to quantify those as well. After you pour in the buffering solution, the nematodes first rise, then fall, but the speed at which they fall depends on the size of the nematodes. If we added a camera system to determine whether the nematodes had completely sunk to the bottom of the solution, the cost would be prohibitive, so we needed to choose as simple an approach as possible. We struggled to find a way to make the nematodes sink at a fairly consistent speed." (Nakamura)

—— It seemed like a brilliant idea to use photography to count the number of nematodes based on the amount of light (the brightness), rather than counting them with the naked eye.

"Yes, the idea was something we had from the beginning, but putting it into actual practice was much harder than we had expected.
We wanted the prototype to be able to perform all of the tasks normally done by hand, but we also had to consider future versions with sufficient throughput (the number of samples that can be analyzed in one day) to make the device useful for initial screening tests.

To realize the specifications that Dr. Hirotsu had in mind, we needed to emphasize both processing capacity and low cost. If the machine's tasks are complicated and the price is high, cost performance suffers and the whole point of using nematodes is lost. So we really tried to keep the design simple. Making a system that could do speedy processing was the hardest part." (Sugaya)

—— Did you have to come up with any special approaches to handle interdisciplinary development bridging medicine and engineering?

"I think the biggest thing was creating an environment where we, as hardware engineers, could work side by side with biologists and interact with them as they did their experiments.

For example, if the nematodes are not in the right conditions, they will not yield reliable test results. We did not understand this until we actually did the tests and saw the problems that arise. We needed to converse with the biologists to find out what was not right about the conditions and being able to have this interaction was invaluable."

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Interviews with Physicians
Their Reasons for Cooperating with Clinical Trials

In addition to automation, there was one more formidable prerequisite for commercializing N-NOSE.

"From a technical perspective, we were able to obtain adequate precision from the approach we used in our laboratory, so I don't think we struggled excessively.
Increasing the number of test cases, however, was quite an obstacle for someone like me who is not working in a clinical setting.
When it came time to take a more full-fledged approach, I did not know where to get samples from, nor did I know whom to go to for assistance.
While dealing with these concerns, I held lectures and seminars. I explained to participants the kind of research I wanted to do and asked if they would collaborate. Fortunately, someone from Nanpuh Hospital in Kagoshima prefecture raised his hand. This gracious offer led to our first batch of data coming from Nanpuh Hospital, which was then followed by a host of other collaborating hospitals as well. I was really lucky to work with a great hospital from the beginning."

The official name of Nanpuh Hospital is "Kagoshima Kyosaikai Public Interest Corporation Nanpuh Hospital." Founded in 1954, it has over 60 years of history as a regional hub hospital. Why was Nanpuh Hospital willing to cooperate in the clinical trials for nematode cancer screening? We interviewed the hospital's deputy director, Dr. Toru Niihara, who is also head of the Department of Gastroenterology.

Dr. Toru Niihara, MD
Nanpuh Hospital Deputy Director
Head of the Department of Gastroenterology.

—— What made you be the first to raise your hand to cooperate with clinical trials?

"The director of our hospital's Clinical Trials Development Office learned about Dr. Hirotsu's research at an advanced medical technology seminar hosted by Nikkei. He was impressed and brought the information back to share with the rest of us. Our hospital sees many cases of gastrointestinal cancer, which piqued my interest in nematode cancer screening and made me eager to collaborate."

—— What specific aspect most piqued your interest?

"The level of precision is remarkable. The sensitivity and specificity are 90% or higher. There have been no cancer tests to date with this level of precision, so it really is remarkable. In order to verify this feature, we decided to provide as many test cases as possible."

—— What steps led up to the actual clinical trial?

"I wanted to be able to offer as wide a range of patient samples as possible, from early-stage cancer to advanced cancer. When a patient came to our hospital and was diagnosed with cancer, I asked the patient if they would cooperate with this research. For those who agreed, we collected blood and urine samples. My specialty is gastrointestinal cancer, so I also had physicians in other departments lend a hand so that we could provide samples from patients with lung cancer and liver cancer."

—— You collected not only urine, but blood samples as well?

"Blood samples were needed in order to make comparisons with conventional tumor markers and to see how capable this new test is. The precision of the tumor markers currently being used is low and a result is only obtained with advanced cancer."

—— Where there any things you specifically emphasized while guiding the trial forward?

"I was careful not to use any form of coercion when asking patients to be part of the trial. Since the request was being made right after they were newly diagnosed with cancer, I expected that many of them would initially refuse and that this was fairly unavoidable. In actually, however, there were few who refused to participate. That was unexpected."

—— How many samples have you collected so far?

"As of September 13, we have data for 50 cases of stomach cancer and 60 cases of colorectal cancer. The numbers for gallbladder cancer and biliary tract cancer are small, but we are gradually collecting more samples for these other types of cases."

—— How is the level of accuracy?

"Currently, we have confirmed an accuracy level of 90% or higher. There is some variation depending on the organ, but overall the accuracy is as we had hoped."

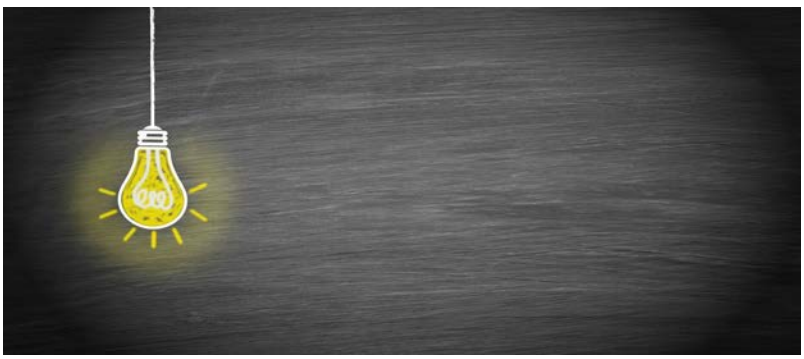
—— Please tell us about your vision going forward.

"Right now, we are cooperating to verify the accuracy that can be obtained in a real clinical setting. Going forward, after the test is commercialized, I think that it will be applicable to more than just initial screenings.

For example, if the test can determine the absence of cancer in patients post surgery or during chemotherapy, we will be able to avoid prolonged chemotherapy. Over and above diagnoses, I think the test is a useful means for seeing the effects of treatment. I think it is also well suited for monitoring cancer metastasis and recurrence.

Also, this really presupposes proof of 90% or higher accuracy, but I think the test can make a substantial contribution to reducing medical costs.
The number of cancer cases actually discovered in people who undergo annual exams is low. Instead, more cases are discovered by chance exams given to people who do not get annual exams.
There really is an element of wasted money at play where cancer exams are concerned. In this sense, it would be wonderful if we could first administer nematode cancer screening, then have those who test positive receive more tests."

Interview with Dr. Hirotsu
How Zero-Cost Clinical Trials Became Possible



Dr. Hirotsu, who stated that "increasing the number of test cases was quite an obstacle, as I was not working in a clinical setting," nevertheless actually benefited from innovative thinking because he was not a physician.

Normally, pharmaceutical companies and medical device manufacturers must approach a university professor when carrying out clinical trials, and the time and expense are considerable. Dr. Hirotsu, however, claims to have paid nothing for his clinical trials.

"I did request collaboration at seminars, etc., but I did not approach any one specific institution. Instead, I waited to be approached by hospitals, etc. that took an interest in and had a desire to support my research.
Since the relationship was one of equality, or even of me responding to their request, I was able to launch the trials for zero yen.

In return, when a physicians asked if he or she could write an academic paper using the clinical data accumulated, I quickly consented. There were benefits available to researchers.

In trying to commercialize the device, we could have had patients ship us urine samples from their homes using delivery services, after which we would return the results to them, but we did not use this approach. We made sure that urine samples were collected at hospitals and results were delivered by the patient's physician, so that if the test were positive, steps could immediately be taken to start treatment. This held merits for the health care institution, which increased the numbers that were willing to work with us."

Currently, in addition to Nanpuh Hospital in Kagoshima, Dr. Hirotsu and his colleagues are also working with 31 hospitals and universities across Japan, including the Shikoku Cancer Center, Saitama Medical University International Medical Center, Osaka University, and Hiroshima University.

"For a venture company, there are two approaches: avoid alliances with anyone else in order to reap all of the profits on one's own, or not think about profits and form alliances with major partners in order to achieve fast growth. We are very much in the latter camp.

After all, N-NOSE is a stage one exam. It is for everyone, those with and those without cancer. In terms of business, the profits are considerable, but as far as percentages, I am not concerned. So, we partnered with companies as well as hospitals.
And, as a result, in just a year since launching the business, we have made dramatic progress."

"Detection with Just One Drop of Blood"
Doesn't this make N-NOSE a competitor with national cancer exams?

There is one aspect that seems like it could be an issue. In terms of tests that can detect cancer from minute samples, teams from the National Cancer Center and elsewhere have developed a test method than can simultaneously diagnose 13 types of cancer from one drop of blood. So, we asked Dr. Hirotsu about this.

—— Is this a formidable rival for the nematode cancer screening test?

"The aims of N-NOSE and the National Cancer Center's test are different. What we are targeting is initial, stage one screening.
It is the first step in cancer diagnosis. Tests being carried out at present do not cover this level of screening."

—— Stage one screening?

"Yes, we feel that a screening is needed that gives an initial, high precision, low cost, simple, and painless test of whether or not cancer is present.
If the result is negative, the patient can rest easy. If the result is positive, the patient would then go on to more intricate stage two screening, like that offered with the test developed by the National Cancer Center, in order to identify the type of cancer.

Currently available tests, like those for tumor markers, are less sensitive (only 20% or so), or are only able to detect very advanced cancer, are quite expensive, like PET-CT tests, or involve inconvenience and pain, like CTs, endoscopy, and mammographies. Some also involve the chance of false negative results depending on the expertise of the examiner, so they are ill suited for stage one screening. Even the National Cancer Center's test is fairly expensive, with an estimated price of 20,000 yen (approximately US$200). The characteristic feature of N-NOSE is its suitability for stage one screening, with a cost of several thousand yen (approximately US$20-30)."

—— Even if a test is expensive, one would quickly agree to it if the results were reliable, correct?

"Yes, but a prerequisite for a stage one screening is an affordable price. On top of that, it needs to be painless, simple, and highly precise. So far, that sort of test just has not been available."

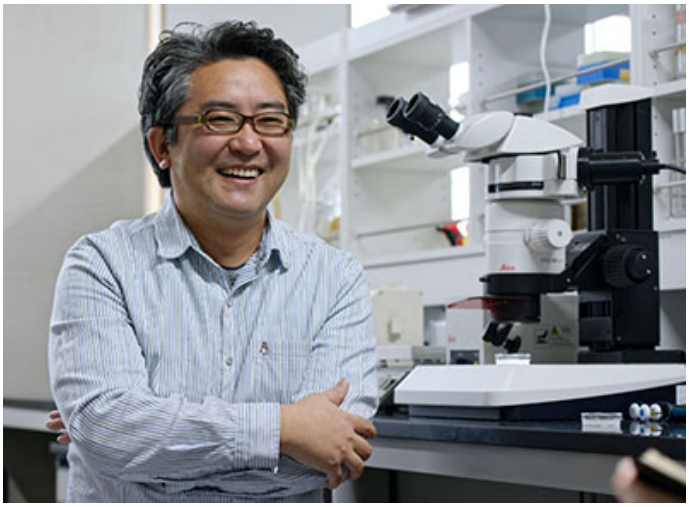
—— Although Japan is a developed nation, one problem is our comparatively low rate of cancer screening, right?

"That is because a test like N-NOSE has not been available. It is no surprise that patients are reluctant when suddenly told to get an expensive and uncomfortable test, despite not knowing whether they actually do or do not have cancer.
But if N-NOSE is commercialized and becomes widespread as an initial screening option, the number of people receiving other cancer tests (beyond stage one) will increase and I expect the entire state of cancer care will undergo great change."

Depending on how N-NOSE is utilized, we may be able to overcome the scourge of cancer threatening us all. The possibilities are tremendous. Once commercialization is achieved inside Japan, the test can be rolled out worldwide.
For that to take place, development of an automated analyzer is needed, then these devices must be installed in testing centers in each region. Since a system for transporting urine samples will also need to be established, there are many pieces to the puzzle.

"We now finally have all of these pieces in place. We have partnered with Hitachi to make the automated analyzer and we are establishing good relationships with other large corporations as well as municipalities."

Like spontaneous mutation, a tiny one-millimeter nematode has transformed into a momentous project. The run up to this grand undertaking is occurring right before our eyes.



Dr. Takaaki Hirotsu
CEO, Hirotsu Bio Science Inc.

1995: Graduated from Tokyo University's Department of Science, Faculty of Biology
2001: Earned Ph.D. upon completing the doctoral program of Tokyo University's Graduate School of Science, Research Department, with a focus in Biochemistry
Research Fellow at the Japan Society for the Promotion of Science (Tokyo University Genetics Laboratory)
Postdoctoral Research Fellow at Kyoto University's Graduate School of Life Sciences, Research Department
Assistant Professor at the Kyushu University Graduate School of Science, Research Faculty, Life Sciences Department
Assumed his current position in 2016

About the writer

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Medical Journalist, interviewer, wiriter.

Shukan Gendai “Nihon Ga Hokoru Top Doctor Ga Akasu” (Kodansha publishing)
Diamond Q “Gan Shinzo byo Nou Socchu, Sonaekata, Tsukiai kata” (Diamond publishing)
“Doctor’s Guide” (Jiji publishing)
Colums at “Diamond Online”