



A voice for science

Convinced by the evidence that vaccines do not cause autism, Alison Singer started a research foundation that pledges to put science first.

The e-mail that ended one career for Alison Singer, but started another, arrived as she was cooking dinner for her daughters one evening in January 2009. Singer was preoccupied. At a committee meeting she was due to attend in Washington DC the next day, she and others were set to vote on a plan that would direct much of the United States' spending on autism research for the next year.

Singer, who had her laptop perched on the kitchen counter, immediately noticed the e-mail from another committee member — a mother who was convinced that vaccines had caused her son's autism. The message proposed last-minute language for inclusion in the plan, endorsing more research into

BY MEREDITH WADMAN

whether vaccines can trigger the disorder of communication and movement. Singer knew immediately that this would cause her serious difficulties. Having read the literature and talked to numerous scientists, she was convinced that no studies supported a link between autism and vaccines. But she was also the top communications executive at Autism Speaks in New York, autism's most prominent research and advocacy group. The organization supports vaccine-related research, and Singer knew that her bosses would expect her to vote for more studies of vaccines as a possible cause of the condition.

At 11:10 p.m., Singer hit 'send' on an e-mail of her own, to Bob and Suzanne Wright, the co-founders of Autism Speaks. "I've concluded

that as a matter of personal conscience, I cannot vote in favor of dedicating more funds to vaccine research that has already been undertaken and which I and many others find conclusive," her message read. "I feel compelled to offer my resignation."

With that, Singer became a solo operator in the world of autism-research funders. Within months, she would launch the Autism Science Foundation (ASF), a tiny New York-based charity with a relentless focus on rigorous science, a niche supporting the youngest researchers and a guiding principle that "vaccines save lives; they do not cause autism."

The ASF is scarcely a blip on the big screen of autism-research spending: in this, its second full year of operations, it is awarding US\$220,000 in grants to young researchers; last year, it spent \$180,000. The two major

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non-governmental players in US autism research, the Simons Foundation in New York and Autism Speaks, last year spent \$54 million and \$21 million, respectively (see 'All change for autism').

But Singer's charity is drawing notice as much for the aims and quality of its work as for its magnitude. In August, GuideStar, a major charity-rating group based in Washington DC, singled out the ASF as a "promising start-up", calling it "a shining star to those interested in real science and evidence based interventions".

The fledgling foundation has also won endorsements from leaders at the American Academy of Pediatrics in Elk Grove Village, Illinois; the National Institutes of Health (NIH) in Bethesda, Maryland; and the Centers for Disease Control and Prevention (CDC) in Atlanta, Georgia. "The Autism Science Foundation is an important voice for scientific direction in the autism community," says Coleen Boyle, the director of the National Center on Birth Defects and Developmental Disabilities at the CDC.

The jury is still out on whether Singer and her tiny organization can do much to combat the perception of a link between autism and vaccines that has become cemented in many minds. But if anyone is going to do it, Singer is a strong candidate. She "is a force of nature", says Thomas Insel, director of the National Institute of Mental Health in Bethesda, which spends more than \$80 million on autism each year — more than half of the NIH's autism budget. "I have enormous respect for her abilities."

"She is one of the most strong-willed people that I have ever met," adds Christie Buchovecky, an ASF-funded graduate student at Baylor College of Medicine in Houston, Texas, who has a 12-year-old cousin with autism. "And she somehow manages to do that while still being extremely caring and supportive. She knows where the parents are coming from."

ALL IN THE FAMILY

On Saturdays 40 years ago, when Singer (then Alison Tepper) was 5 years old and wanted to be in ballet class, she and her parents would set out on a very different errand: visiting her autistic 7-year-old brother, Steven, at the Willowbrook State School, an institution on Staten Island, New York, that housed more than 5,000 people diagnosed with mental retardation and developmental disabilities. Singer's parents had placed Steven in Willowbrook out of fear for their children's safety. Steven could be self-injurious and a danger to others; once, he had brought a whole wall unit,

including a television, crashing to the floor.

Willowbrook was a Dickensian institution that would eventually come to symbolize everything that was wrong with the way America cared for its mentally ill. In 1965, New York Senator Robert Kennedy alluded to the facility as "a snake pit". In 1972, an undercover exposé by local television channel WABC-TV showed residents sitting and staring vacantly; rocking, often naked, in overcrowded, barren rooms; or abandoned on bathroom floors. When Singer

"People didn't talk about it then. There was a tremendous stigma associated with autism."

and her family visited Steven, they would see him only in the visitors' room. Still, the stench of urine bothered Singer. So did the noise. "There was a lot of screaming," she recalls. "I didn't like it."

In 1971, shortly before the documentary aired, the Tepper family moved from the New York borough of Queens to the suburbs, and transferred Steven to a nearby facility called Letchworth Village. In time, the family — Singer also has a younger brother — began visiting Steven less often. Singer's mother, who had been told she was to blame for Steven's condition, instructed her daughter to tell people that she had just one, younger, brother. "People didn't talk about it then. No one talked about it," Singer says. "There was a tremendous stigma associated with autism."

Singer carried her secret out of childhood as she set out to become a journalist. In 1993, having graduated with a degree in economics from Yale University in New Haven, Connecticut, and a master's from Harvard Business School in Boston, Massachusetts, she was hired as vice-president of programming for the cable division of television network NBC. Singer was charged with bringing news content to desktop computers through the new phenomenon called the Internet. She married in 1994; in 1997, her first daughter, Jodie, was born. Singer thought something was wrong, she says, "from the day she was born". Jodie cried constantly. She didn't want to eat. She wouldn't sleep. One diagnosis followed another: failure to thrive; early colic; late colic. "I just thought I didn't have the mommy gene," Singer recalls.

She started questioning her mother over and over. "Did Steven ever do this? Did Steven ever behave like this?" My mom would say: 'No, Steven never did that.' Singer also took heart from a conversation with an obstetrician who assured her that autism is "not genetic". Still, as Jodie became a toddler, Singer remained deeply

troubled by her inability to communicate. "She used to recite the *Madeline* book from beginning to end perfectly," says Singer. "But if I said, 'Do you want juice?' she couldn't answer yes or no."

Singer called the state department of health several times to schedule an assessment for Jodie. Each time, in a rush of ambivalence, she would call back and cancel. Finally, she made a firm appointment. When a psychologist and a case worker visited her at home, Jodie was two

years, eight months old. (Singer had just given birth to Jodie's healthy younger sister, Lauren.) Singer expected them to say that nothing was wrong. Instead, they diagnosed Jodie as severely autistic, telling Singer gravely, "Don't worry, we're going to get her help." When they were gone, says Singer, "I just bawled".

Then, she says, "I pulled myself together".

DRIVING ON

'Together' seems an apt word for Singer. She comes across as organized, articulate and, above all, driven — although not without a sense of humour. On a September day, Singer showed this reporter around what she jokingly referred to as "the worldwide headquarters" of the ASF: a cubicle on the fourth floor of a lower Manhattan office building. There, Singer's one paid member of staff — Jonathan Carter, a recent college graduate with an autistic brother — was labouring over the just-relaunched ASF website. Singer herself does not draw a salary.

It's a long way from the high-flying position she held at Autism Speaks, where in her last year she made \$187,000. Bob and Suzanne Wright had made Singer their first employee when they launched the group in 2005, shortly after their grandson was diagnosed with autism. They were well placed to make things happen: Bob Wright was chief executive of media conglomerate NBC Universal and vice-chairman of General Electric, NBC's parent company. During the group's first months, when Singer served as interim chief executive, she, Suzanne Wright and an assistant constituted the entire staff. Working with a shared passion and purpose, from an office on the 51st floor of NBC Universal's headquarters, Singer and Suzanne Wright became fast friends. "Suzanne doesn't take no for an answer and neither do I. So we got a lot done," Singer recalls.

Their completed to-do list included landing coverage for Autism Speaks on television



THE AUTISM ENIGMA

Sorting fact from fiction
nature.com/autism

programmes *Oprah* and *Larry King Live*, and in the pages of *The Wall Street Journal*. Singer turned the organization's website into the most highly trafficked in the autism world. The group, she later wrote in her resignation e-mail, "elevated 'autism' to the global vocabulary". In 2008, Singer's final year with Autism Speaks, the charity raised more than \$70 million.

But there was friction, too. The Wright's daughter, Katie, fervently believed that vaccines were the cause of her son's autism, and was pushing her parents to fund more vaccine research. This didn't sit well with Singer. Although she had been open to such research when Jodie was first diagnosed, Singer had followed the growing number of studies that debunked any link between autism and the once-suspect measles, mumps and rubella vaccine, or between autism and thimerosal, a mercury-containing preservative that was used in some early-childhood vaccines until 2001. For the past several years, she says, the data have been very clear. "There were no studies indicating a link between autism and vaccines." As time went on, Singer became increasingly uncomfortable with her organization's continued funding of vaccine-related research. She was even more disturbed by its failure to state, publicly and unequivocally, that all the data show that vaccines do not cause autism.

The committee meeting in January 2009 brought matters to a head. The Interagency Autism Coordinating Committee, a group of federal-agency and public representatives, was charged with developing an annual strategic plan for autism research, which would be used to guide work done by federal agencies, both internally and in collaboration with private foundations. Singer refused to support a plan that would broadly sanction vaccine studies. "She knew that her resignation would be seen as a desertion," says Paul Offit, chief of infectious diseases at the Children's Hospital of Philadelphia in Pennsylvania, and now a close colleague of Singer's and a member of the ASF's board of directors. "It was a very, very hard thing for her to do."

The day after she resigned, Singer spoke at the committee meeting, letting members know how she was going to vote, and why. There were two votes related to vaccine research at the meeting. The first, on whether to add the language that had circulated the previous evening, failed. The committee also voted on whether to cut two existing vaccine-research objectives from the plan. All the other members representing advocacy groups or affected families opposed removing the objectives; Singer and the federal-agency scientists did not, and the objectives remained. Autism Speaks immediately put out a press release distancing itself from Singer and withdrawing its support for federal autism-research plan.

Suzanne Wright has not contacted Singer, or replied to e-mails from her, since Singer resigned. But Singer did receive many supportive messages. "I understand your reasons completely and agree with you wholeheartedly," wrote one supporter, Mark Krinsky, whose son, now 25, has autism. "What are your plans? Any group would be lucky to get you but maybe you should start a new one. I will volunteer."

It was letters and phone calls such as these, says Singer, "that got me thinking about starting a new advocacy group". She launched the ASF in March 2009.

PERSONAL CHALLENGE

Singer, who drives a blue Honda minivan decorated with bumper stickers reading "Autism Science Foundation" and "Vaccinate your baby", spends two days a week working from her home in Scarsdale, an upmarket northern suburb of New York. This allows her to juggle a mother's duties with her work. One Monday afternoon, she arrives home from the office to find Lauren, now 11, downstairs finishing her homework, and Jodie, 14, upstairs with Keith Amerson, one of her therapists. Amerson, who is an expert in a leading autism therapy called applied behaviour analysis (ABA), has been working with Jodie since she was diagnosed.

Today, Jodie is sitting beside Amerson at a table, in front of two plastic plates. The yellow one has one piece of toy food on it; the green one has several. "Jodie, which one has more?" asks Amerson. Jodie points to the yellow plate.

When her mother comes in, Jodie lights up. The two bounce on the bed in Jodie's bedroom

and sing a song, that, Singer says, they have sung "a thousand times". Jodie: "Say: 'I love my Jodie.'" Singer: "I love my Jodie."

But Jodie is challenging. She sleeps for as little as four hours a night. Every door and window in the house has had an alarm ever since, in the wee hours one winter morning, shoeless and clad in pyjamas, she set off down the driveway in search of an egg roll at a Chinese restaurant. Luckily, Singer was awake and stopped her.

When Amerson pushes Jodie to find the prices beside pictures of root beer and cake on a sheet of paper, and enter them in a calculator, Jodie cries "Oh no!" and runs her flapping, nervous hands through her brown pony tail. "Do you need some help?" asks Amerson. "Keith!" replies Jodie. "Say: 'I need some help,'" counters Amerson. "I need some help," Jodie says.

The goal of ABA therapy, says Amerson, "is to make her as independent as possible and to improve the quality of her life". A task as quotidian as writing '\$1.74' legibly, with the decimal point in the right place, is a large challenge, its achievement a victory. "It's very tough work," he says.

YOUNG BRAINS

On 8 February 2010, almost a year after it launched, the ASF awarded its first grants, splitting \$180,000 between six PhD students. Singer has chosen to focus on the youngest scientists because, she says, "it fuels the pipeline for the future. You are encouraging that person to pursue autism research as opposed to research in some other disease." The foundation boosted its funding by more than 20% this year, handing



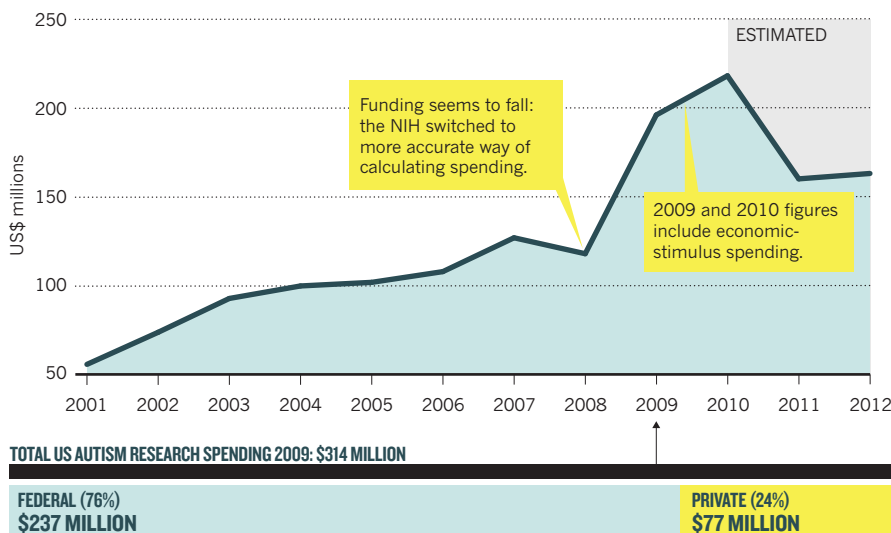
Alison Singer (right) in 1968. Her brother Steven (left) has autism, as does her daughter Jodie.

A. SINGER

SOURCE: NIH

All change for autism

Funding for autism research from the US National Institutes of Health (NIH) has risen in recent years (top). In 2009, federal funding dwarfed that from private sources (bottom), although this is also rising.



out a further six awards to graduate students and postdoctoral researchers.

Chosen by a ten-member scientific advisory board, the awards run the gamut from basic science to diagnosis and treatment. One 2011 recipient, Jill Locke at the University of Pennsylvania and the Children's Hospital of Philadelphia, is working to translate behavioural techniques proven in the research setting to Philadelphia's public schools. She is training school personnel to improve the social interactions between children with autism and their playground peers. Another recipient is Haley Speed, a postdoctoral fellow at the University of Texas Southwestern Medical Center in Dallas, who is building on work that she recently co-authored in *Cell*, describing a mouse with a mutation in the *Shank3* gene, which is linked to autism in humans (M. A. Bangash *et al. Cell* **145**, 758–772; 2011). In the past, Speed had failed to win NIH postdoctoral awards, and she believes that the riskiness of her current research — in which she hopes to find compounds that could correct the animals' abnormal neuron-to-neuron communication and restore normal behaviour — would not help her case with conservative study sections at the biomedical agency. “The ASF had faith in us, whereas the NIH did not,” she says.

Speed adds that it inspires her to know that \$10 and \$20 donations from affected families are paying for her work. “On a bad day, if your equipment breaks or your experiment fails — which they all do — it gives you an extra boost as you to go pick yourself up and do it all again.”

Indeed, many donations to the ASF come in small cheques from affected families and

their friends, or larger ones from the proceeds of football goal-a-thons and charity motorbike rides. (A significant amount has also come from large donors, including Offit, who has donated all the royalties from the sales of his books challenging the anti-vaccine movement to ASF — an amount he estimates in tens of thousands of dollars.) Singer does not think that her opposition to vaccine research limits the group's ability to raise funds — far from it. She says the organization has mobilized the thousands of families who were sick of the autism story being hijacked by the vaccine hypothesis. “ASF is their voice.”

The ASF is still dwarfed by the size and reach of other organizations supporting autism research. The Simons Foundation does not fund vaccine research, but Autism Speaks spends about 2% of its budget — nearly twice as much as the ASF spent on all research this year — on studies that are relevant to vaccines, says Geri Dawson, chief science officer for Autism Speaks and a professor of psychiatry at the University of North Carolina at Chapel Hill. “We are not funding any studies that directly address whether vaccines cause autism,” says Dawson. “The evidence strongly suggests that there is not a link between autism and vaccines. What we are trying to understand through our research funding is the role of the immune system in autism, which certainly could be relevant to the question of vaccines.”

For instance, Dawson says, Autism Speaks is funding studies investigating the idea that disorders in the cellular powerhouses, mitochondria, might influence responses to immune challenges such as infection and immunization. “We are willing to leave the

door open for the possibility of rare cases in which an immunization may have triggered the onset of autism symptoms due to an underlying medical or genetic condition.”

Singer calls Dawson's words “a carefully crafted ‘big tent’ political statement designed to appeal to both sides of the issue” and an attempt “not to offend any potential donors on either side”. Her concern, she says, is that statements suggesting that the jury is still out on autism and vaccines put children “at risk for vaccine-preventable disease”.

In an e-mail, Katie Wright wrote that she “totally respects” Singer's beliefs about Jodie. “However, Alison doesn't live my life, doesn't know what caused my son's autism and wasn't with me the night he had a febrile seizure or the day he stopped talking. It is important not to tell other parents you know better than they do about their child's autism. We all love our kids very much, Alison and I certainly agree on that.”

THE LONG HAUL

Although the world of autism research is expanding, horizons for many of those with the condition have scarcely changed. Singer's brother, Steven, lives in a group home in Rockland County, not far from Scarsdale. Now 47, he attends a day programme and helps to deliver Meals on Wheels three mornings a week. Still, he has never spoken, and needs round-the-clock supervision. “If he had had early intervention when he was two, when his brain was more malleable, then who knows where he would be today,” says Singer, who visits him several times a year. “But I'm a big believer that you never stop trying.”

Singer is not deterred by the sometimes agonizingly slow pace of science, or by the stark fact that the genetics and aetiology research that her foundation is funding is unlikely to ever directly benefit Steven or Jodie. Singer now believes that her daughter's autism was largely caused by genes, but genetic testing when she was first diagnosed revealed no known pathogenic deletions or duplications in her genome. Singer had Jodie retested earlier this year, after a glut of studies identified mutations implicated in autism. The tests still came up empty.

Nonetheless, Singer believes that the ASF's research into treatment will improve the lives of people who have autism today — including Jodie. She also focuses on her other daughter, Lauren, who has already asked whether she, too, will have a child with autism.

Says Singer: “I would like to be able to answer her with: ‘If you do, we will know how to help.’” ■ SEE EDITORIAL P.5

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