

# CAREERS

CITIZEN SCIENCE

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## Amateur Experts

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**Introduction to Biomedical Informatics, June 10, 2013**

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# Outline

- **Creative Concept**
- **Projects/ Institutes/ Application fields**
- **Powerful strength in numbers**
- **Real Examples/ photos**
- **Challenges**
- **Conclusion**

# Creative Concept

- **Citizen Science**

"public participation in scientific research."

PPSR

- **Amateur experts**

Involving members of the public can help science projects—but researchers should consider what they want to achieve.

# **Citizen science**

"the systematic collection and analysis of data; development of technology; testing of natural phenomena; and the dissemination of these activities by researchers on a primarily vocational basis".

"public participation in scientific research."

# Amateur experts (1)

- Equipped with smartphones, computers and **do-it-yourself (DIY) sampling kits**, lay volunteers are tweeting about snowfall, questing for comets and measuring the microbes in their guts.
- part of a growing group of '**citizen scientists**'
- Recruiting non-scientists who help to analyze or collect data as part of a **researcher-led** project.

# Amateur experts (2)

- It offers a means of doing substantial, thoughtful public outreach, and of tackling otherwise **intractable, laborious or costly research problems**.
- recruiting non-scientists comes with complications, including finding the **right technical tools** and partners to **organize** and execute projects with potentially thousands of data collectors.

# **Projects/ Institutes/ Application field**

It is difficult to measure the growth in citizen science accurately, in part because many ventures overlap with science-education efforts, but projects are definitely becoming more common.

Institute	Projects	Members	Application field	Academic
Citizen Science Alliance	Planet Hunter	Christopher Lintott	Astrology	Oxford U
<b>1 in 2007</b>	Nature's Notbook	Jake Weltzin	Ecology	Arizona U
<b>Has hosted</b>	Video Game	Justin Halberda	phenology	Johns Hopkins U
<b>Over 20 now</b>	Old Weather	Philip Borhan	Psychology	Met office
<b>Launch 10/200 proposals</b>	Sacred tree/log	Jerome Lewis	Climate science	Hadley Center in Exeter
	Trap/animals	Muki Haklay	Social anthropology	U College London
			Geographic	UCL
SciStarter	<b>Over 450 *boast</b>	Public		
Citizen Science Central	<b>162</b>	Rick Bonney*	Ornithology	Cornell U
NSF, National Science Foundation	Paleo Quest SharkFinder	Andrea Wiggins Jason Osborne	Social Science Paleontology	New Mexico U



# Christopher Lintott



- An astronomer at the University of Oxford, UK,
- and chair of *the Citizen Science Alliance*, which hosts projects and advises researchers
- Planet Hunter

# The Citizen Science Alliance (CSA)

- began with one project in 2007 and has now hosted more than 20
- WHAT IS THE CITIZEN SCIENCE ALLIANCE?
  - The CSA is a collaboration of scientists, software developers and educators who collectively develop, manage and utilize internet-based citizen science projects in order to further science itself, and the public understanding of both science and of the scientific process. These projects use the time, abilities and energies of a distributed community of citizen scientists who are our collaborators.

<http://www.citizensciencealliance.org/>

# SciStarter



## projects of the day



### Urban Buzz: Cicadas!

**goal** Help gauge possible negative effects urbanization on cicadas.  
**task** Collect and send us 5-10 dead cicada in good condition.

Like 0 GA to CT comments

## projects of the day



### Where's the Elderberry Longhorn Beetle?

**goal** Help Drexel Univ learn how this beetle's populations change.  
**task** Search for this beetle and upload your pictures!

Like 1 Anywhere comments

## projects of the day



### Project NOAH

**goal** Help scientists with ongoing research.  
**task** Document nature with your mobil phone.

Like 0 Anywhere comments

## projects of the day



### Ventus

**goal** Help study climate change impacts of power plants.  
**task** Map locations of power generators around the world.

Like 0 Online comments

## projects of the day



### Aurorasaurus

**goal** Help build accurate predictions of visible aurora activities.  
**task** Report on whether you can or cannot see the Northern Lights.

Like 0 Anywhere comments

<http://www.scistarter.com/>

# Citizen Science Central

- Cofounded by **Rick Bonney**, an ornithologist at Cornell University in Ithaca, New York, who in 1995 coined the term citizen science — lists 162 projects.
- What is Citizen Science and PPSR?
  - The growing field of public participation in scientific research (PPSR) includes citizen science, volunteer monitoring, and other forms of organized research in which members of the public engage in the process of scientific investigations: asking questions, collecting data, and/or interpreting results.



<http://www.birds.cornell.edu/citscitoolkit>

# Jake Weltzin

- An ecologist at the University of Arizona in Tucson
- is executive director of the USA National Phenology Network, which runs a project called Nature's Notebook.
- Citizen scientists track how climate affects the timing of life-cycle events in plants and animals.



“This is a whole new way of doing science,” says Weltzin.

“Being able to think about and collect data at a continental scale.”

# Application fields

- Citizen Science
- Astronomy 天文
- Ornithology 鳥類
- Phenology(Ecology, Climate) 現象(生態氣候)
- Psychology 心理
- Social anthropology 社會人類學
- Paleontology 古生物學

# **Powerful** Strength in numbers Reach Out

人多好辦事

Citizen science can help researchers to address previously insoluble problems.

Citizen science can also educate and engage.

# Justin Halberda



A psychologist at Johns Hopkins University in Baltimore, Maryland, wanted to study how cognition develops as people age.

***“no scientist would have been able to generate these data”, says Halberda.***

- He originally thought that he would need to gather data from **tens of thousands of people of all ages** over the course of years, a feat that would be financially and logistically impossible for one research team with a limited budget.
- Asking volunteers to play a sort of **video game** that measures number sense the ability to estimate how many items there are in a collection without actually counting them.



# Philip Brohan

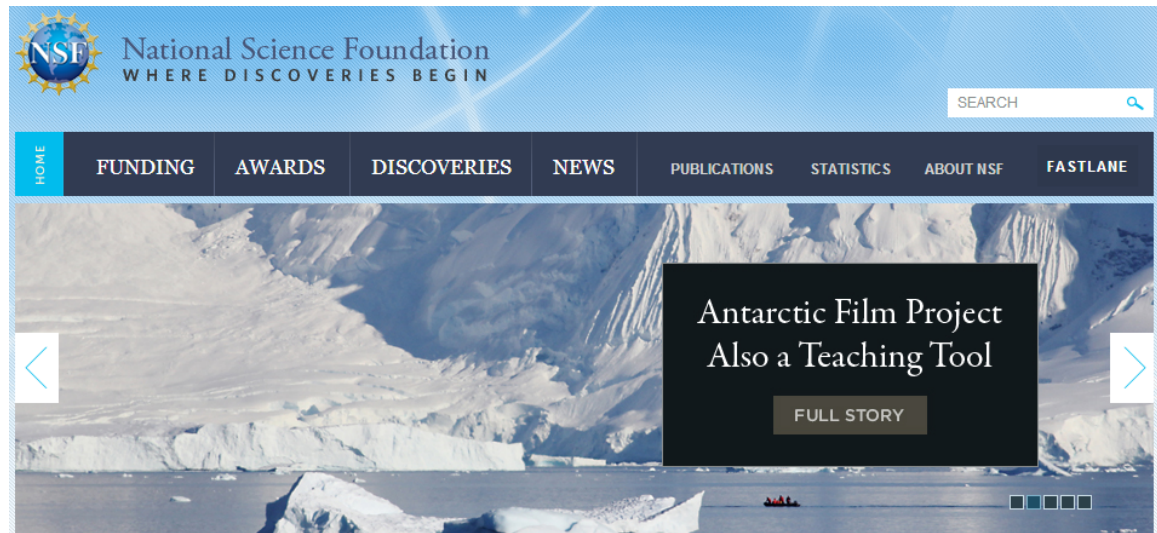


- A climate scientist at the Met Office Hadley Centre in Exeter, UK.
- his colleagues build up data sets using weather records from nineteenth-century ships.
- Old Weather

# National Science Foundation(NSF)

<http://www.nsf.gov/>

- requests a description of a project’s “broader impact” for many of its grants, including early-career development awards. Citizen science is a great way to meet your broader-impact requirements, says Weltzin.



- It can also get the public involved in research that **can inform environmental or governmental policy.**

# **Real examples/ Photos**

# Case I.

- Citizens helped to collect data on noise levels near a scrapyards in the London district of Deptford.
- Citizen scientists showed that the operation violated noise limits, and the UK Environment Agency revoked the scrapyards' license.

## Case II. Jerome Lewis

- Members of communities in the Congo Basin are set to aid land and animal conservation.
- A social anthropologist at University College London (UCL), was working with pygmy hunter-gatherers in Rwanda and other areas in the region when they told him about poachers killing animals and loggers destroying natural resources, such as sacred trees.

# Case II. Jerome Lewis



“If we find a way to go to the extremes of citizen science, we can do all kinds of really interesting stuff.”

Haklay

## Case III.

- Deal with poachers will launch this April. Data such as the locations of snares will be shared with policy-makers to attempt to reduce the killing of endangered animals.
- As an added feature, the phones come with a thermoelectric battery charger, which can convert heat from campfires to electricity.



# Case IV.



**Jack Meixner tracks juniper phenology in Texas as part of a citizen-science project on pollen.**

# GETTING STARTED

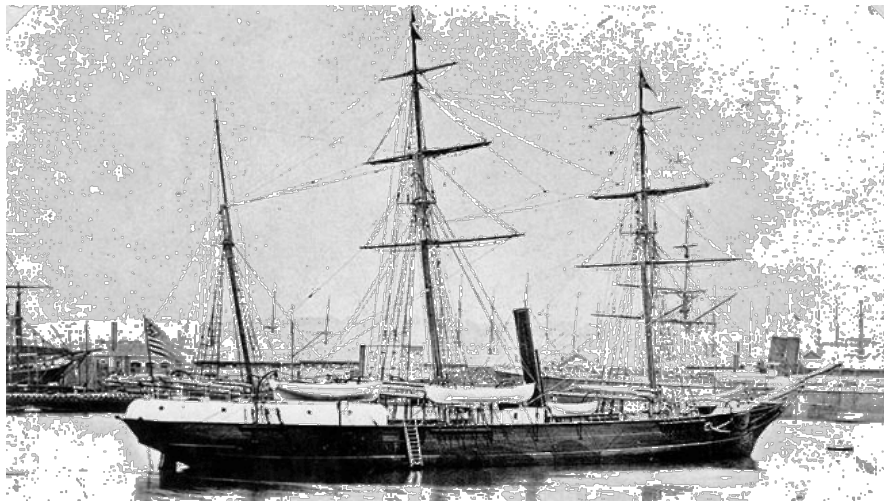
- Launching a citizen-science project involves a few essential steps.
  - First, come up with a question that takes full advantage of a network of amateur data-collectors.
  - Next, seek guidance from people who have already built these kinds of projects, such as the Citizen Science Alliance.

# WHAT TO WATCH FOR **Challenges**

1. People management
2. Guarantee the quality of the data
3. Recruiting volunteers and keeping them engaged

# Citizen science might appear to be all upside and little downside

- A way to get others to do cheaply what researchers cannot or do not want to do. But that thinking can lead to trouble.
- “Citizen science is enormously expensive in terms of time and effort managing people, websites and databases,” says **Brohan**



# Challenges

- **People management**

- Andrea Wiggins

- a social scientist who studies citizen science at the University of New Mexico in Albuquerque as part of DataONE
    - an NSF-funded project aimed at increasing the availability of Earth and environmental data.
    - “You don’t necessarily know who is on the other end of a data point”



The screenshot shows a webpage from The Cornell Lab of Ornithology's Citizen Science Central. The header includes the lab's logo and the title 'Citizen Science Central'. A navigation menu on the left lists 'Projects', 'Resources', 'Contexts', and 'Conferences'. The 'Conferences' section is expanded to show '2012 Conference on Public Participation in Scientific Research', with sub-links for 'Registration Details' and 'Agenda'. The main content area features a profile for Andrea Wiggins, a Postdoctoral Fellow at the University of New Mexico. A small portrait photo of her is shown next to a text block describing her as an interdisciplinary researcher who studies sociotechnical systems for large-scale collaboration, with interests in data-intensive science, distributed collaboration, and social computing.

<http://www.birds.cornell.edu/citscitoolkit/conference/2012/agenda/speakers/wiggins>

**It is difficult to guarantee  
the quality of the data.**

It could be a retired botany professor  
reporting on wildflowers or a pure  
amateur with an untrained eye.

Scientists have to design their projects and protocols for anyone to follow, and must perform regular quality control.

Planet Hunters

# Planet Hunters--Lintott

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## Department of Physics



### Chris Lintott

Researcher and Citizen Science Project Lead

[cjl@astro.ox.ac.uk](mailto:cjl@astro.ox.ac.uk)

My background is in work on the chemistry associated with star formation, but these days I run citizen science projects to investigate galaxy formation, discover planets and more. You can see the current range of projects by following the link below.

VIEW MY RESEARCH GROUP

### Contact

### Publications

*To track how well citizen scientists can spot transits, and to measure the sensitivity of the system to different kinds*

1. Insert fake planet signals
2. Do the same task on the same data

01865 (2)73638

WC Keel, A Manning, BW Holwerda et al.

Planet Hunters. V. A Confirmed



The sheer scale of the projects can create quality-control challenges.

The eBird project

# The eBird project

The Cornell Lab of Ornithology

## Citizen Science Central

Projects > Cornell Laboratory of Ornithology >

# eBird

**eBird** is jointly coordinated by the **Cornell Laboratory of Ornithology** and **National Audubon Society**



**25 million observations a month handpicked  
→ reviewing less or automating**

**Description:**  
A real-time, online checklist program, eBird has revolutionized the way that the birding community reports and accesses information about birds. eBird provides rich data sources for basic information on bird abundance and distribution at a variety of spatial and temporal scales. By maximizing the utility and accessibility of bird observations made each year by recreational and professional bird watchers, eBird is amassing one of the largest and fastest growing biodiversity data resources in existence. The observations of each participant join those of others in an international network of eBird users. eBird then shares these observations with a global community of educators, land managers, ornithologists, and conservation biologists. eBird documents the presence or

**Projects**

- Project Registry
- Finding Projects
- Cornell Laboratory of Ornithology
  - NestWatch
  - Project FeederWatch
  - eBird
  - BirdSleuth
  - Celebrate Urban Birds
  - House Finch Disease Survey
  - Birds in Forested Landscapes
  - YardMap

**Resources**

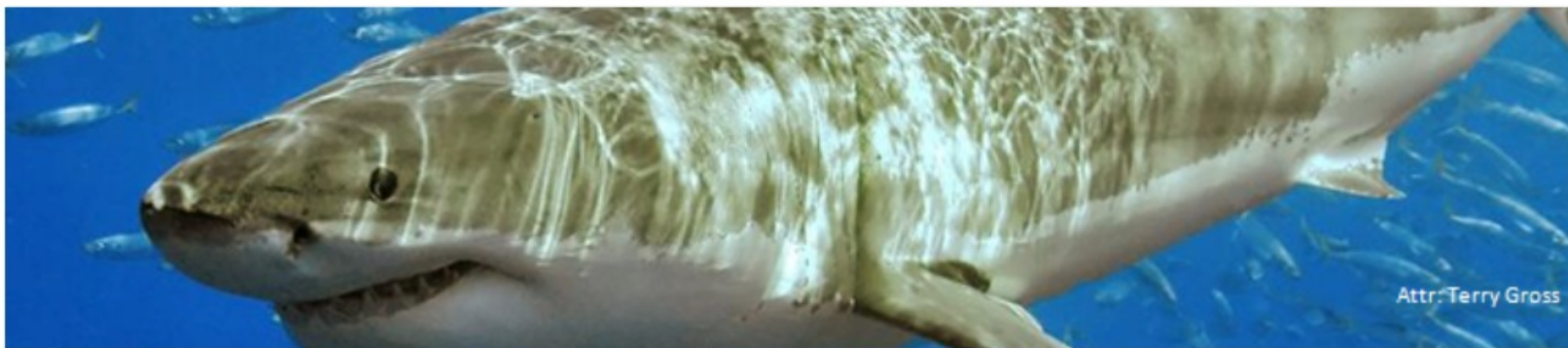
“The science has to be romantic,  
in a way, so that people want to  
support the research behind it”

Jason Osborne, president and co-  
founder of Paleo Quest, a citizen-  
science organization focused on  
palaeontology.

Projects have to be interesting, tangible and involve discovery

# SharkFinder

PALEO  
QUEST



- Home
- SharkFinder Process
- Kit Instructions
- Waste
- Fossils
- Contact Us

Welcome to the website for the SharkFinder™ program!

# SharkFinder

- “You put Panama in the kit, and kids are like, ‘Wow, I have a piece of Panama on my desk, and I am looking for fossil remains’,” says Osborne, noting that kids also love handling prehistoric fossils.
- “There has got to be that kind of wow factor.” And if they discover a new species, Osborne’s citizen scientists might be named on a publication or even be given the opportunity to name the species.

Whatever a volunteer's motivation  
even if it is just the joy of  
participating scientists have to  
understand and nurture it.

# The ways to keep volunteers engaged

- Old Weather-Brohan's team
  - Come up with a ranking system
- Classify images of storms-Scott Steven's team
  - Identify the best and invite them to do more
- As projects evolve, organizers can contact those super users and invite them to participate at a higher level, perhaps by helping to analyze data or to manage groups of other citizen scientists.

The challenge of getting citizen-  
science data through **peer review**

But that barrier is diminishing.



Publications using data from citizen science are becoming more common, and even encouraged.

- Researchers at Princeton University in New Jersey, for example, have used data from Nature's Notebook to expand a model of the timing of leaf-bud bursting from the Harvard Forest area in Massachusetts to the entire eastern seaboard of the United States. The team published its expanded model this year (S.-J. Jeong et al. *Geophys. Res. Lett.* 40, 359–364; 2013).

Not only did peer reviewers welcome the citizen science data, but one actually gave advice on how to use the citizen-science model more effectively, says Weltzin.

# Conclusion

- If all goes well, citizen science is a way to communicate science, engage in outreach and accomplish research aims.
- “You are getting the information that you need at the same time that you are getting people involved,” says Weltzin.
- “It is like playing Whack-a-Mole with all hammers out. You meet all of your objectives at one time.”



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**Thanks for Attentions!**