

# NGS/Waite Grant Application

## Principal Investigator Information

Please enter the following information about the person who will be leading the proposed project (i.e., the Principal Investigator) of this project.

The Principal Investigator (PI) must apply for funding in her/his own name. The applicant must be the Principal Investigator.

Prefix

e.g., Dr., Ms.

Dr.

First Name

Corina

Middle Initial

e.g., A.

J.

Last Name

(Surname)

Logan

Institution

University of California, Santa Barbara

Department

Psychological and Brain Sciences

Street Address

Sage Center for the Study of the Mind  
Bren Hall 4328

City  
Santa Barbara

State / Province  
CA

Zip / Postal Code  
93106-9660

Country  
United States

Telephone Number  
+447868357294

Telephone Extension

Fax Number

E-mail Address  
itsme@corinalogan.com

Current Position and/or Rank  
SAGE Junior Research Fellow

## Biographical Information

Date of Birth  
08/12/1978

Country of Primary Citizenship  
USA

Institutional affiliation(s) other than listed above, with position and rank

How did you hear about our program? Please select one option from the drop-down list.

NG Web site

If you learned about our program from another source, please specify.

Please note: If you choose to save this application and complete it at another time you must create a new on-line applicant account (if you do not already have an account). When directed to the account page after pressing save, please select that you are "A New On-Line Applicant" and create your account accordingly.

## Educational Background

Please list your degrees in reverse chronological order. Start with your most recent or highest degree.

### 1. Degree Awarded

Ph.D.

Department or Major

Experimental Psychology

Year Degree Awarded

2012

School/Institution

University of Cambridge

### 2. Degree Awarded

B.S.

Department or Major

Biology

Year Degree Awarded

2004

## School / Institution

The Evergreen State College

### 3. Degree Awarded

<None>

Department or Major

Year Degree Awarded

School / Institution

## Project Information

Please enter the following information about your proposed research.

Today's Date

30/05/2012

Title of Project

Is sophisticated cognition restricted to large-brained species?

Start Date of Your Field Work

01/11/2012

End Date of Your Field Work

31/08/2014

### Amount Requested from the Society

Enter all amounts in US funds, rounded to the nearest dollar, with no punctuation or symbols. Example: 14600

14172

### Total Project Budget

17718

Is the research proposed here a dissertation project?

No

If this proposal constitutes the main focus of a dissertation then the application should be submitted by the graduate student.

### Special Qualifications of the Principal Investigator

Corina Logan holds a PhD in animal behavior from the University of Cambridge and has been researching birds and mammals in the field and lab for eight years.

Please provide an abstract of your proposed project which includes the significance of the research and is written free of scientific terminology. (250 word maximum)

'Bird brain' was considered an insult until a recent discovery that bird brains have a similar structure to that of the mammalian neocortex (the cognitive processing center). Researchers have begun looking for, and finding, avian intelligence in the large-brained species: crows use tools, rooks cooperate to get food, and scrub-jays plan for the future. But is intelligence restricted to species with large brains? This project investigates intelligence in a highly innovative, but small-brained bird, the great-tailed grackle. Innovation rates increase with brain size across species, however the grackles have much higher innovation rates for their relatively small brains, making them the best candidate outside of the large-brained species in which to look for intelligence. Additionally, this study will be carried out in the wild to understand how and why their cognitive abilities evolved: investigating how these abilities are used in the daily lives of the animals will indicate which factors shaped their intelligence. I will compare grackles with large-brained New Caledonian crows to examine how the two species differ in their performance on cognitive tests, which will elucidate the benefits provided by an increase in brain size. The results will greatly expand our knowledge of intelligence: in which species it exists and why, how it develops, and how it compares between species of differing brain sizes.

In which major field of science do you classify this project? Please select up to three choices.

Biology

Biology-Vertebrate Animals-Birds

Classification. Please select up to three choices that apply to your research.

Behavior  
Evolution

Geographic Location of Fieldwork. Please select up to three choices.

North America-United States-California  
Oceania-French Territories-New Caledonia

Geographical Feature. Please select up to three choices.

Does your project involve travel to, or expenditures in, Cuba, Iran, Sudan, Syria, Zimbabwe, Somalia, or North Korea?

No

Please select "Waite" from the list below.

Waite

## Mapping Coordinates

Please enter the latitude and longitude coordinates of the geographic location(s) of your fieldwork in decimal degrees format (not degree-minute-seconds format). For example, Machu Picchu, located at 13° 09' 00" S, 072° 30' 28" W, would be entered as -13.15 (latitude) and -72.5078 (longitude). Be sure to enter north and east coordinates as positive values, and south and west coordinates as negative values.

Please enter at least one point that is representative of your work. If you have more than one site as part of your project, please enter up to five points in the fields below. If you need help locating the coordinates or to double-check your coordinates before submitting your application, this website may be of assistance: [Google Map Lab](#) You will need to enable the LatLng Marker tool in the Google Maps Lab.

### Location One

Enter values in decimal degrees format. Do not enter in degree-minute-seconds format.

Latitude

Longitude

## Location Two

Latitude

Longitude

## Location Three

Latitude

Longitude

## Location Four

Latitude

Longitude

## Location Five

Latitude

Longitude

# Additional Participants

Please enter the following information for up to five

Please enter the following information for up to five additional participant(s) of your project, if applicable. If you have more than five additional participants, please send us an e-mail with information about the extra participants: [NGS/Waite Grant Program](#)

Researchers planning work in countries other than their own should include as part of their research teams at least one local collaborator.

## 1. Additional Participant

Prefix

e.g., Dr., Ms.

Dr.

First Name

Alex

Middle Initial

H

Last Name

(Surname)

Taylor

Institution

The University of Auckland

Department

Psychology

Street Address

Private Bag 92019

City

Auckland

State/Province

<None>

## Zip/Postal Code

1142

## Country

New Zealand

## Telephone Number

6493737599

## E-mail Address

alexhtaylor@gmail.com

## Date of Birth

25/04/1983

## Country of Primary Citizenship

United Kingdom

## Highest Degree Awarded

Ph.D.

## Department or Major

Psychology

## Year Degree Awarded

2010

## School/Institution

The University of Auckland

## 2. Additional Participant

### Prefix

e.g., Dr., Ms.

### First Name

Middle Initial

Last Name

Institution

Department

Street Address

City

State/Province

<None>

Zip/Postal Code

Country

<None>

Telephone Number

E-mail Address

Date of Birth

Country of Primary Citizenship

Highest Degree Awarded

<None>

Department or Major

<None>

Year Degree Awarded

School/Institution

### 3. Additional Participant

Prefix

e.g., Dr., Ms.

First Name

Middle Initial

Last Name

Institution

Department

Street Address

City

State/Province

<None>

Zip/Postal Code

Country

<None>

Telephone Number

E-mail Address

Date of Birth

Country of Primary Citizenship

Highest Degree Awarded

<None>

Department or Major

<None>

Year Degree Awarded

School/Institution

## 4. Additional Participant

Prefix

e.g., Dr., Ms.

First Name

Middle Initial

Last Name

Institution

Department

Street Address

City

State/Province

<None>

Zip/Postal Code

Country

<None>

Telephone Number

E-mail Address

Date of Birth

Country of Primary Citizenship

Highest Degree Awarded

<None>

Department or Major

<None>

Year Degree Awarded

School/Institution

## 5. Additional Participant

Prefix

e.g., Dr., Ms.

First Name

Middle Initial

Last Name

Institution

Department

Street Address

City

State/Province

<None>

Zip/Postal Code

Country

<None>

Telephone Number

E-mail Address

Date of Birth

Country of Primary Citizenship

Highest Degree Awarded

<None>

Department or Major

<None>

Year Degree Awarded

School/Institution

## Previous NGS Grants and Affiliations

Number of previous grants from the National Geographic Society.

0

All previous grants from NGS must be closed before a new grant is awarded. If you have an active grant please contact [NGS/Waite Grant Program](#) for instructions on closing your grant.

[Click here](#) for instructions on closing your grant.

Starting with the most recent, please list your last five National Geographic Society grants.

1.

Grant Number

Grant Amount

Project Title

Resulting Publications

2.

Grant Number

Grant Amount

Project Title

Resulting Publications

3.

Grant Number

Grant Amount

## Grant Amount

Project Title

Resulting Publications

4.

Grant Number

Grant Amount

Project Title

Resulting Publications

5.

Grant Number

Grant Amount

Project Title

Resulting Publications

## NGS Affiliations

Please list any previous affiliations you may have had with either the National Geographic Society (NGS) or National Geographic Ventures (NGV). Affiliations may include, but are not limited to, the following NGS/NGV divisions: National Geographic magazine; National Geographic Traveler, National Geographic Adventure, National Geographic Kids, and National Geographic Explorer magazines; NGS Lectures; NGS Exhibits; National Geographic Books; Expeditions Council; Conservation Trust; NG Explorers Program; National Geographic Television; National Geographic Digital Media (including NG News).

None.

## Publication Record

Please list five of the Principal Investigator's publications most relevant to the present proposal and five additional publications of the Principal Investigator.

Most relevant publications:

1. Logan CJ, O'Donnell S, and Clayton NS. 2011. A case of mental time travel in ant-following birds? *Behavioral Ecology* 22(6):1149-1153.
2. Logan, CJ, and Pepper, JW. 2007. Social learning is central to innovation, in primates and beyond. *Behavioral and Brain Sciences* 30:416-417.
3. Logan CJ, Longino JT. (Accepted). Adult male coatis play with a band of juveniles. *Brazilian Journal of Biology*.
4. O'Donnell, S, Kumar, A, and Logan, C. 2010. Army ant raid attendance and bivouac-checking behavior by Neotropical montane forest birds. *Wilson Journal of Ornithology* 122(3):503-512.
5. Logan, CJ, and Montero, C. 2009. *Bothrops asper* (Terciopelo) scavenging behavior. *Herpetological Review* 40(3):352.

Additional publications (note: these are the rest of my publications, however I have three in review at the moment):

1. Logan CJ, Emery NJ, and Clayton NS. 2011. Squabbles and snuggles: how corvids handle conflict. *Natural History Magazine*, June, pp. 18-19.
2. Logan, CJ. 7 July 2010. Settling arguments, the corvid way: Kiss and make up or snuggle with your partner? Why it matters what you do after a fight. *New Scientist*.

## Where do you plan to have the results of this research published?

Nature, Science, Current Biology, Proceedings of the National Academy of Sciences, Animal Behaviour, Behavioral Ecology

## Please list any publications by your Additional Participants that pertain to this proposal.

Taylor, A.H & Clayton N S. 2011 Evidence from convergent evolution and causal reasoning suggests that conclusions on human uniqueness may be premature. Behavioral and Brain Sciences (in press).

Taylor AH, Elliffe E, Hunt, GR, Emery NJ, Clayton NS, Gray RD 2011 New Caledonian crows learn the functional properties of novel tool types PLoS One 6 (12), e26887.

Taylor, A.H., Hunt, G. & Gray R.D 2011 Context dependent tool use in New Caledonian crows. Biol Letts.

Medina, F. S. Taylor, A.H., Hunt, G. & Gray R.D 2011 New Caledonian crows' responses to mirrors Anim. Behav.

Taylor, A. H., Elliffe, D., Hunt, G. & Gray R.D 2010 Complex cognition and behavioural innovation in New Caledonian crows, Proceedings of the Royal Society B, 277: 2637--2643.

Taylor, A. H., Medina, F., Holzhaider, J.C., Hearne, L., Hunt, G.R. and Gray, R.D. (2010). An investigation into the cognition behind spontaneous string pulling in New Caledonian crows. PLoS One 5, e9345.

Taylor, A. H. and Gray, R.D. (2009). Animal cognition: Aesop's fable flies from fiction to fact. Current Biology 19, R731-R732.

Taylor, A. H., Hunt, G. R., Roberts R. & Gray, R. D. 2009b Causal reasoning in New Caledonian crows: ruling out spatial analogies and sampling error. Comm. Integ. Biol. 2, 311-312.

Taylor, A. H., Hunt, G. R., Medina, F. S. & Gray, R. D. 2009a Do New Caledonian crows solve physical problems through causal reasoning? Proc. R. Soc. Lond. B 276, 247-254.

Taylor, A. H., Hunt, G. R., Holzhaider, J. C. & Gray, R. D. 2007 Spontaneous metatool use by New Caledonian crows. Curr. Biol. 17, 1504-1507.

## Budget Details

Please enter budget information about your project,  
fitting items as closely as possible into the categories

fitting items as closely as possible into the categories provided.

If you are not requesting funds for a particular budget category, please leave the field blank.

Enter all amounts in US funds, rounded to the nearest dollar, with no punctuation or symbols. Example: 5200

NGS/Waite grants range from US\$5,000 - US\$15,000. Because NGS/Waite grants are intended to function as the sole or primary source of seed money for a project, we recommend a streamlined budget and a minimal number of applications for complementary funds from other granting agencies.

NGS/Waite grants are given for one year's field research. Publication costs are not normally allowed, nor may grant money be used for indirect costs, overhead, or other expenses not directly related to the project. Fringe benefits are also excluded, as are salaries for those with faculty or staff status or any other paid professional affiliation. Funds may not be used for travel to professional/scientific meetings or conferences, nor may they be used for publication page charges or to pay educational tuition. In addition, the Society does not offer scholarships of any kind.

## TRANSPORTATION

### 1. Airfare

#### Brief Description

Santa Barbara to New Caledonia to test crows for comparison with grackles

#### Amount Requested from NGS - US\$

3421

#### Amount Requested from Other Sources - US\$

0

#### Detailed Justification

Please provide the source by which airfare was determined and clearly identify the individuals (by function and name, if known) for whom airfare is being sought.

## Sought.

Economy airfare quote was obtained from kayak.com for travel for Corina Logan (PI).

## 2. Vehicle Rental

Vehicle rental is often expensive in foreign countries. The PI is frequently required to rent a vehicle with a local driver, which further adds to the cost. This budget item must be carefully considered in light of accepted practice and standard rates for a particular country. In exceptional circumstances, it might actually be cheaper to buy a used vehicle locally, but the insurance and other financial implications of such an acquisition must be carefully considered. Gas prices vary widely around the world, especially where the supply of this commodity is sparse.

### Brief Description

Amount Requested from NGS - US\$

Amount Requested from Other Sources - US\$

## 3. Vehicle Gas and Maintenance

### Brief Description

Amount Requested from NGS - US\$

Amount Requested from Other Sources - US\$

## 4. Other Transportation Needs

### Brief Description

Taxi/bus in New Caledonia

Amount Requested from NGS - US\$

Amount Requested from Other Sources - US\$

0

## SUBSISTENCE

Please ensure that the per diems for lodging and food are comparable for the visiting team and the local collaborators. Lodging should cover the cost of adequate, suitable, and moderately priced housing in the respective country. Food should cover the cost of up to three adequate meals per day.

The [US State Department](#) provides annual lists of permissible per diem rates, which are helpful in establishing the maximum subsistence rates for particular domestic and foreign locations.

Even in cities, investigators can normally achieve much lower rates. In the field, we expect your rates to be much lower. Incidental travel expenses (e.g., laundry) should not exceed 10 percent of the combined lodging and meal cost.

Enter all amounts in US funds, rounded to the nearest dollar, with no punctuation or symbols. Example: 8650

### 5. Lodging

#### Brief Description

Accommodation in New Caledonia for 6 weeks

Amount Requested from NGS - US\$

0

Amount Requested from Other Sources - US\$

1500

### 6. Food

#### Brief Description

Meals for the 6 weeks in New Caledonia

Amount Requested from NGS - US\$

Amount Requested from Other Sources - US\$

500

## 7. Other Subsistence Needs

Brief Description

Amount Requested from NGS - US\$

Amount Requested from Other Sources - US\$

## FIELD WORK

### 8. Field Equipment

Major non-expendable equipment requests (over US \$1,000) should be identified by brand, model number, and unit cost. The disposition of non-expendable equipment purchased with National Geographic funds should be enumerated in your final report/financial accounting. Typically such equipment may be donated to the host country or institutions or held for the continuation of the project.

Brief Description

Trapping, marking, and conducting behavioral experiments with great-tailed grackles

Amount Requested from NGS - US\$

10101

Amount Requested from Other Sources - US\$

150

Detailed Justification

Please explain how the equipment is integral to the proposed research and not available through other sources of funding.

These are the essential materials for trapping and marking the birds, taking DNA samples for genetic testing, building the cognitive testing apparatus, and video recording cognitive tests. There are few sources of funding for equipment, therefore I am applying to the National Geographic Society for the bulk of it, and will use departmental research funds for the rest.

applying to the National Geographic Society for the bulk of it, and will use departmental research funds for the rest.

The only expense that exceeds \$1,000 are the satellite tags by Microwave Telemetry, Inc., which cost \$3450 each. I will use these to track the birds to their nesting habitat and to determine whether flock territories overlap.

## 9. Field Supplies

### Brief Description

Food for baiting traps and testing apparatus, and for the aviary birds

### Amount Requested from NGS - US\$

600

### Amount Requested from Other Sources - US\$

0

## 10. Field Assistants and Consultants

The hiring of assistants, consultants or specialists should be restricted to the actual needs for such services. Assistants should receive compensation above food and lodging that is consistent with local rates of compensation and should be explicitly justified in the Assistants and Consultants Detailed Justification field. For students from developed countries, funding is normally limited to per diem expenses. We do not reimburse tuition.

### Brief Description

One field assistant for trapping and marking birds

### Amount Requested from NGS - US\$

0

### Amount Requested from Other Sources - US\$

1000

### Detailed Justification

Please explain the need for any field assistants you have included in your budget. Please identify all assistants and consultants by function and name (if known), and include an explanation of how compensation for assistants and consultants was determined (i.e., by hourly rate or by task).

A field assistant will be needed to help trap and band birds periodically. Pay will be \$10 per hour, which is above minimum wage.

## 11. Other Field Work Needs

Brief Description

Amount Requested from NGS - US\$

Amount Requested from Other Sources - US\$

## COMMUNICATIONS

### 12. Telephone/Fax/Postage

Brief Description

Amount Requested from NGS - US\$

Amount Requested from Other Sources - US\$

Detailed Justification

Please explain how any support requested in this category is essential in arranging for and undertaking fieldwork as well as facilitating transfer of collections to the appropriate destination(s) for preparation and study.

## MISCELLANEOUS

### 13. Miscellaneous

Brief Description

Federal and state permits

Amount Requested from NGS - US\$

0

Amount Requested from Other Sources - US\$

## Amount Requested from Other Sources - US\$

396

### Detailed Justification

Please explain any items that do not fit into one of the predetermined budget categories.

Permits fees for the US Fish and Wildlife Service Collecting Permit, US Geological Survey Master Bander Permit, and the California Department of Fish and Game Scientific Collecting Permit to handle great-tailed grackles in California, extract blood and feathers, band them, observe them in the field, and bring them into temporary aviaries.

## Budget - Funding From Other Sources

Please list the amounts and types of support already received for this project from individuals or institutions other than the National Geographic Society.

### 1. Funding Source

#### Name of Funding Source

University of California, Santa Barbara, Department of Psychological and Brain Sciences

#### Description

Research funds available to Corina Logan through a fellowship

#### Amount

3546

### 2. Funding Source

#### Name of Funding Source

#### Description

#### Amount

### 3. Funding Source

Name of Funding Source

Description

Amount

### 4. Funding Source

Name of Funding Source

Description

Amount

### 5. Funding Source

Name of Funding Source

Description

Amount

If you are receiving no such support or aid, please explain briefly.

Applications now pending with other funding organizations for this work.

Please indicate the date by which you expect to receive notification and include electronic copies of any relevant budgets.

If other applications are listed above, are they alternative to this request to the National Geographic Society?

If "Yes," and an alternative grant is received, you must notify the Society.

No

## Reviewers

Please enter the names and complete addresses of three individuals competent to provide us with an appraisal of your project and/or evaluation of your qualifications and ability to successfully do the work involved.

Applicants are encouraged to contact their reviewers in advance to ensure rapid reviewer response and to expedite application processing.

### 1. Reviewer

Prefix

e.g., Dr., Mrs.)

Dr.

First Name

Nicola

Last Name

Clayton

Institution

University of Cambridge

## Department

Experimental Psychology

## Street Address

Downing Street

## City

Cambridge

## State/Province

<None>

## Zip/Postal Code

CB2 3EB

## Country

United Kingdom

## Telephone Number

+441223333559

## E-mail Address

nsc22@cam.ac.uk

## 2. Reviewer

### Prefix

(e.g, Dr., Mrs.)

Dr.

### First Name

Alex

### Last Name

Thornton

### Institution

University of Cambridge

### Department

Experimental Psychology

## Street Address

Downing Street

## City

Cambridge

## State/Province

<None>

## Zip/Postal Code

CB2 3EB

## Country

United Kingdom

## Telephone Number

+441223741826

## E-mail Address

jant2@cam.ac.uk

## 3. Reviewer

### Prefix

(e.g., Dr., Mrs.)

Dr.

### First Name

Patrick

### Last Name

Bateson

### Institution

University of Cambridge

### Department

Sub-Department of Animal Behaviour

## Street Address

High Street

## City

Madingley

## State/Province

<None>

## Zip/Postal Code

CB23 8AA

## Country

United Kingdom

## Telephone Number

+441223741818

## E-mail Address

ppgb@cam.ac.uk

# Project Description

Please describe clearly, and with the minimum of specialized terminology, your proposed project in suitable detail in the space provided.

State your objective(s) and relate your planned research design to previous and current work on the subject by yourself and others, being sure to cite relevant literature.

Detail your methodology, noting any special or unusual tools or techniques you plan to employ.

The length of this description should be the equivalent of 3 pages of text or approximately 1,500 words.

We are at the beginning of an era of research on avian cognition: exciting discoveries are occurring in laboratories that demonstrate non-human animals possess sophisticated cognitive abilities. By expanding this research to explore these abilities in

the wild, we can uncover the role evolution plays in producing specific cognitive functions. We know that large-brained birds and mammals are capable of sophisticated cognition because they solve tasks that require reasoning, flexibility in learning, and they can recognise and track others' social relationships (Shettleworth 2010). What we do not know is whether such cognition is restricted to species with large brains. Outside of the large-brained birds, there is one genus, *Quiscalus*, that has exceptionally high innovation rates for its relatively small brain size, making it a cognitive mystery (Lefebvre et al. 2004). How can a small-brained bird produce such high levels of innovation? They may have evolved a cognitive shortcut or perhaps they explore their environment so extensively that they happen upon different innovations 'accidentally'. It is also possible that they possess sophisticated cognition. I will test the hypothesis that sophisticated cognition is restricted to large-brained species by examining cognition in the small-brained great-tailed grackle (*Quiscalus mexicanus*).

The number of novel foraging techniques are a measure of innovation and they positively correlate with brain size, when corrected for body size, across species (Lefebvre & Sol 2002). I will conduct field work in Santa Barbara, California to examine whether grackle innovativeness is driven by exploration or sophisticated cognition. Grackles are abundant and easily accessible in the Santa Barbara area and I will catch and individually color-mark flocks to identify study subjects.

My proposed research aims to generate answers to the following questions:

1. Are grackles capable of sophisticated reasoning? I will set grackles a task involving pulling up a string in different contexts to get a reward. This task examines whether an individual uses associative learning or certain aspects of causal reasoning (Taylor et al. 2010a, Heinrich & Bugnyar 2005, Werdenich & Huber 2006). A valuable object hangs on the end of a string that is attached at one end to a perch. The object (food) is unreachable via the air or ground, thus the task is solved by standing on the perch, grabbing a piece of the string with the bill, pulling it up and tucking that bit under the foot, then repeating the process until the object is within reach. Birds will be trained until successful and then the following transfer tests will be used to determine if subjects have an understanding of the functional aspects of causal relationships. One variation, the broken string task, will test for a causal understanding between the string and the object by providing the standard string pulling scenario, except now the string is cut in the middle and has a large visible gap (Tomasello & Call 1997). If a bird has a causal understanding of this task, it should not pull the string because this will not result in object acquisition. Because the act of the object's approach as the animal pulls the string may be rewarding, another variation will be conducted in which the bird does not have visual access to the object from the perch (Lefebvre et al. 2004). A piece of wood will be placed just below the perch, with a small hole in the center to allow the string and object to pass through as it is pulled up.
2. Do grackles remember and update information about social networks? I will test the grackles' ability to recognise third-party relationships by playing the song of a female's mate in his absence when she is soliciting attention from another male. Remembering and updating information about social networks should be a cognitively demanding task and may have been a factor in the evolution of large brains (Jolly 1966, Humphrey 1976). The ability to recognise third-party relationships is considered one of the more difficult aspects of social cognition. To test third-party recognition in this species, I will base the methodology on Cheney and Seyfarth's (1980) study on vervet monkeys (*Cercopithecus aethiops*). This test involves playing an audio recording of the song of a female's mate at a time when the mate is out of view and a first-year or resident male is present with the female. If the sneaking male leaves the area upon hearing the song (but not upon hearing another male's song), then this indicates he can recognise individual vocalisations, remember past interactions between the female and her mate, and that he has an understanding of the pair relationship between two other individuals.
3. Do grackles learn by observing others? The ability to acquire information by observing others is considered a form of social cognition (Jolly 1966, Humphrey 1976). Social learning and brain size are positively correlated in birds and primates (Reader & Laland 2002, Bouchard et al. 2007). The ability to learn from other individuals will be examined via the tube/flap box (Hoppitt et al. submitted). The box has two ways to access the food inside: through a tube at one end or a flap at the other. The box will be placed in the middle of a clearing; the first bird to solve the task via the tube will be the tube demonstrator, and the first to access the food through the flap will be the flap demonstrator. Individuals will be recorded if they approach, interact with, or solve the task, or see another do any of these behaviors. This information will be processed via a stochastic mechanism-fitting model which was designed to study social learning in the wild with the power of a laboratory analysis (Hoppitt et al. submitted). This model identifies mechanisms of social learning (i.e., imitation, emulation, local enhancement, and stimulus enhancement) and accounts for interactions among these mechanisms. Identifying mechanisms of learning is important for understanding the cognitive processes involved in the transfer of information (Heyes 1994). I will collaborate with Dr. Will Hoppitt (University of St Andrews) to adapt the model to great-tailed grackles in this study, which will provide the data for the graphical model. This test will occur once per flock, resulting in six replicates at two field sites.
4. Is grackle cognition positively correlated with brain size and innovativeness? Within-species differences in cognitive performance as it relates to differences in brain size have not been yet been examined. I will investigate within-species innovativeness by quantifying the number of different foraging techniques per flock. Individual propensity for exploration will be measured to examine if it relates to performance on cognitive tasks. A proxy for relative brain size will be used to determine if innovation and cognition scores correlate with brain size within the species. Due to time constraints, instead of measuring actual relative brain sizes by collecting brains from subjects in this study, I will use a proxy for relative brain size. To estimate brain size, skull width will be measured with calipers. This measure will be validated by determining if skull width correlates with endocranial volume using volume data from Sara Overington (McGill University) and by seeking permission from the Smithsonian Institution's National Museum of Natural History's collection to measure great-tailed grackle skull widths. Additionally, between-species comparisons will be made by examining grackle performance relative to similar reports on other species. Multiple tests will be conducted on the same individuals, allowing for comparison of physical and social cognition. If both correlate positively with brain size, it would indicate a general process in the brain causing such cognition to occur. If one correlates positively and the other negatively with brain size, physical and social cognition may be modular, involving disparate mechanisms.
5. Do cognition and innovative abilities change as individuals develop from juveniles to adults? It is unknown how cognitive abilities change across life stages in wild animals. If social or asocial learning is involved with the ability to innovate or possess sophisticated cognition, then these abilities should change as individuals develop. There is evidence that advanced cognitive skills improve with age, but the precise mechanisms for the development of cognition are unclear. Social learning and environmental exploration are potential mechanisms that will be examined. Juvenile grackles will complete the physical and social cognition tests above, and will be tested at regular intervals to determine when certain cognitive abilities develop, if they do. Tasks will be

modified to match their level of capability to clarify what they are able to solve and what they are not.

6. Are levels of cognition and innovation differentially distributed according to social status? Aside from sex differences, cognitive variation among individuals of the same species has not been investigated. Individuals within grackle society have different roles: females lay on nests inside a residential male's territory and bachelor males without territories sneak copulations with females. Differences in these life histories could differentially drive adaptations involving the need to innovate or use sophisticated cognition to solve their unique problems. I predict that males will have more advanced cognitive capabilities which may have developed to facilitate sneaking copulations and potential counterstrategies by residential males.

7. How does sophisticated physical cognition in great-tailed grackles differ from large-brained New Caledonian crows? I will replicate the tasks set out in aim number 1 and present several other tasks that examine physical cognition to New Caledonian crows (*Corvus moneduloides*). The best evidence of sophisticated physical cognition in birds is from the large-brained New Caledonian crows who use tools and appear to attend to the causal relationships between tools and their effects (Taylor et al 2009a & b, Taylor et al. 2010b). By conducting the same tests using the same methods on both species, I will be able to directly compare the cognitive abilities of species with different brain sizes. This will allow us to understand the functions that large brains provide an animal. Aside from Epstein's (1987) study showing that one pigeon connected four separate behaviors into a novel sequence, there have been few attempts to demonstrate that small brains are capable of complex behaviours. By examining the limits of grackle cognition, in comparison with New Caledonian crow cognition, I will be able to identify specific ways in which large brains provide cognitive benefits.

Aims 5 and 6 will be carried out in aviaries at the University of California, Santa Barbara in Professor Stephen Rothstein's laboratory in the Department of Ecology, Evolution and Marine Biology. Birds will be trapped and placed in the aviary for testing, and then released back to the wild after two months. This will enable me to manipulate each subjects exposure to specific individuals in the tasks, which will allow me to understand more about the mechanisms involved in their abilities. Aims 1 and 7 will be carried out in collaboration with Dr. Alex Taylor and Professor Russell Gray at the University of Auckland.

This project will investigate whether sophisticated cognition exists outside of the large-brained species by testing one of the most likely small-brained species to show such abilities. Studying these abilities in the wild will provide a context for why and how they evolved, which will fill a large gap in our knowledge of the evolution of cognition. Further, it will elucidate the cognitive differences between large- and small-brained species, which will allow us to understand what benefits large brains provide. This study will also show whether innovation rates are directly linked with cognitive abilities, validating whether innovation rates are an appropriate behavioral proxy for cognition. These results will significantly impact the fields of animal cognition, behavior, zoology and psychology. As I explore these cognitive mechanisms, I plan to apply relevant aspects to conservation, education, and medicine.

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## P.I. Certification on Ethical Issues

Have you obtained all of the necessary permits to undertake this work in the country in which it will be conducted?

No

If not, when will you have them?

01/11/2012

When applicable, have you obtained all permits for the temporary/permanent export of specimens or artifacts from the country of origin and temporary/permanent import into your country?

<None>

If not, when will you have them?

Do you agree to abide by the conditions for sharing data and information outlined in the 2003 National Research Council report? \*

Yes

What, if any, will be the local response to your research? Will it in any way offend cultural or religious sensibilities of local communities? What can you do to prevent that outcome? To what extent does your research enhance local scientific capacity?

The great-tailed grackle research in Santa Barbara, CA will not be offensive and will likely spark public curiosity. Grackles are considered an annoying pest species, so the fact that I am investigating their cognition will likely intrigue people and provide an excellent educational opportunity.

The New Caledonian crow research is part of a long-term study site in New Caledonia where governmental and local collaborators are already established. Therefore, local response will not be different when I arrive to carry out the 6-week project.

What steps will be taken and who will be responsible for preservation of the field or study site, especially in the case of archaeological projects, on completion of the project?

Preservation of either study site is not applicable. The grackle research will be carried out in an urban area. Permission from private and public landowners will be acquired to allow access to the property to study the birds. The New Caledonian field site is based out of a constructed aviary and also requires no preservation.

Are the sample sizes involved in handling or collecting specimens or artifacts appropriate?

Yes

Are appropriate voucher specimens being preserved?

In what public collection will they be deposited?

Santa Barbara Museum of Natural History

Is it possible you might be collecting or handling more specimens than are necessary to draw your conclusions?

No

If you are collecting biological specimens, is such collection necessary?

<None>

If you are collecting biological specimens, will such collection harm the population?

<None>

For those handling animals: Would your protocols be approved if your research were in your own country? (For example, by the IACUC in the USA?) \*\*

Yes

For those handling fossils: Would your protocols meet the criteria established by the Society for Vertebrate Paleontology? [SVP Criteria](#)

<None>

For those working with archaeological materials, including human remains: Do your protocols for recovery, conservation, and long-term curation of archaeological materials comply with the policies of the host country?

<None>

Do they follow the ethical guidelines endorsed by the Society for American Archaeology? [SAA Guidelines](#) As well as those of the Archaeological Institute of America? [AIA Guidelines](#)

<None>

For those working with living human subjects: Do your protocols for conducting research involving living humans meet the criteria established by the American Anthropological Association? [AAA Guidelines](#)

<None>

Do they meet the criteria established by the code of ethics adopted by the American Sociological Association? [ASA Code of Ethics](#)

<None>

If you are affiliated with an institution of higher education, it is your responsibility to comply with the regulations of your institution's Institutional Review Board, including protocols on human subject research if applicable to your project. Indicate your compliance by checking the box below.

Yes

\* "Sharing publication-related data and materials: Responsibilities of authorship in the life sciences" / The National Academies Press, Washington, DC / <http://fermat.nap.edu/catalog/10613.html#toc>

\*\* Some US universities require the following assurance for work done in the field on animals:

Assurance: I certify that I will conduct the project in accordance with the PHS Guide for the Care and Use of Laboratory Animals, USDA regulations (9 CFR Parts 1, 2, 3) and the Federal Animal Welfare Act (7 USC 2131 et. Seq.) and that all personnel who have significant exposure to animals will be enrolled in the University Occupational Health Program for Animal Handlers. I further certify that these studies do not unnecessarily duplicate previous experiments.

Different countries have different protocols; there are too many to list individually here and investigators must check their own country's rules. An example, however, is Australia, where investigators should follow the Australian Model Code of Practice for the Care and Use of Animals for Scientific Purposes. The code was produced jointly by the Standing Committee on Agriculture and Resource Management (SCARM), together with the National Health and Medical Research Council (NHMRC), Australian Research Council (ARC), CSIRO, and the Australian Vice-Chancellors' Committee (AVCC).

## Attachments

**Title****File Name**

Curriculum vitae  
Image

[LoganCV.pdf](#)  
[WaiteGrantGraph.jpg](#)

Files attached to this form may be deleted 120 days after submission.