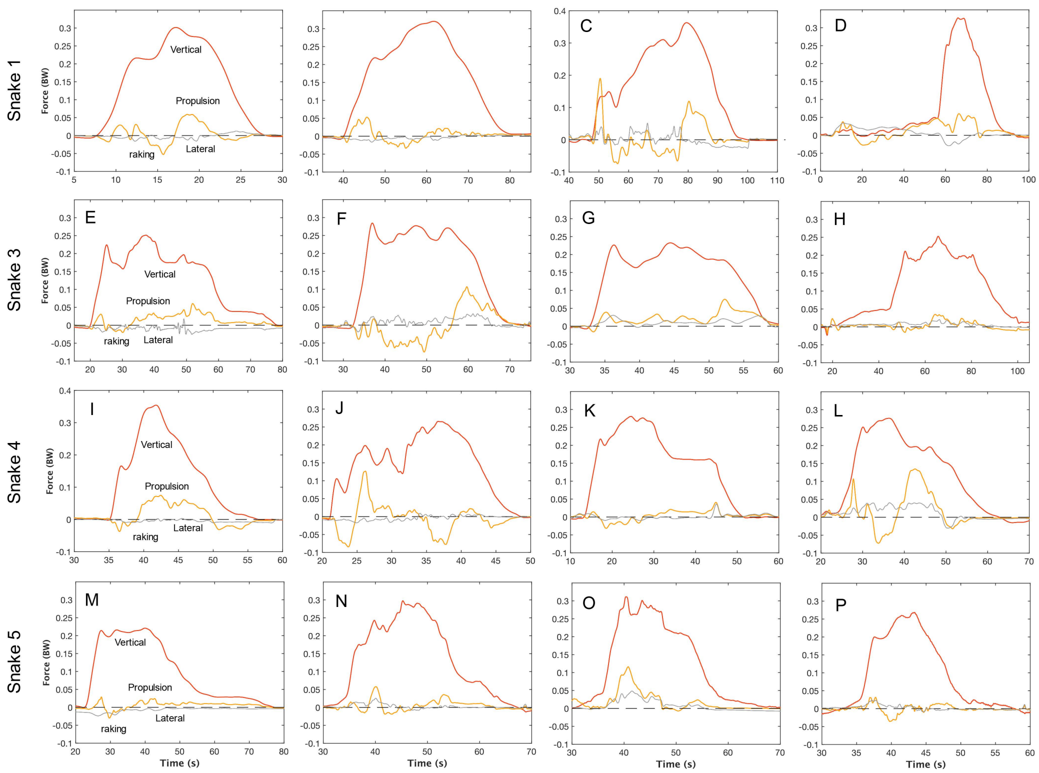

Fig. S1. All trials we obtained showing the forces (BW) as the snake passed along the force-sensing dowel. Trials involving snake 1 are represented by A-D, snake 3 E-H, snake 4 I-L, and snake 5 M-P. Snakes 2 and 6 were not included as they would not cooperate.

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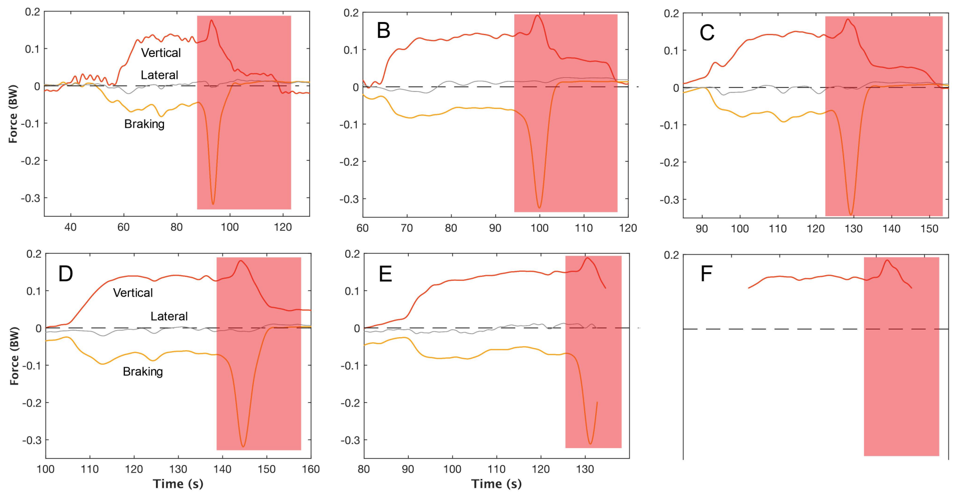


Figure S2. All trials obtained from the inert nylon rope dragged across the force-sensing dowel. The red region shows when the rope fell off the dowel adjacent to the force-sensing dowel, generating substantial forces due to inertial motion. This region was excluded from our analysis.

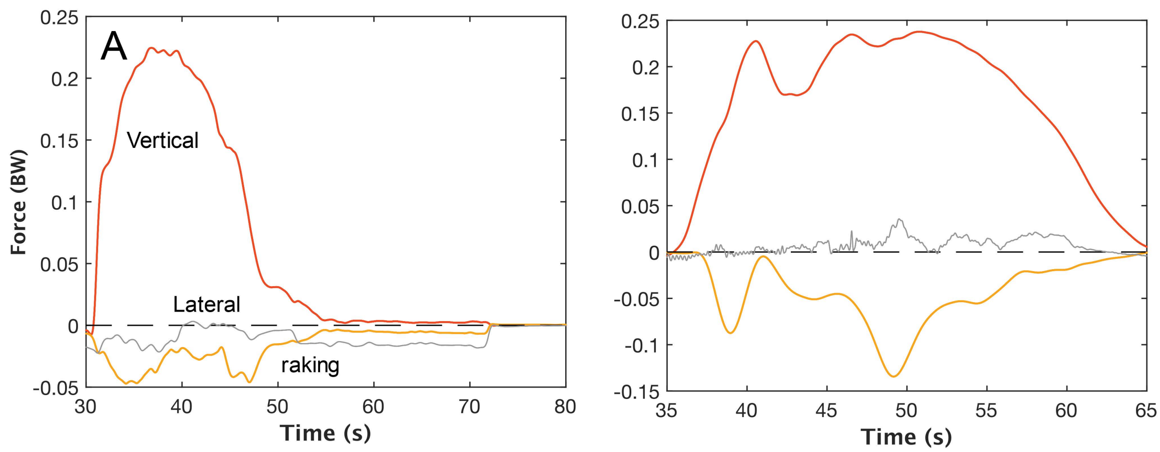


Fig. S3. All trials obtained that have purely braking force (or nearly so). Trials are from snake 4 (A) and snake 3 (B).

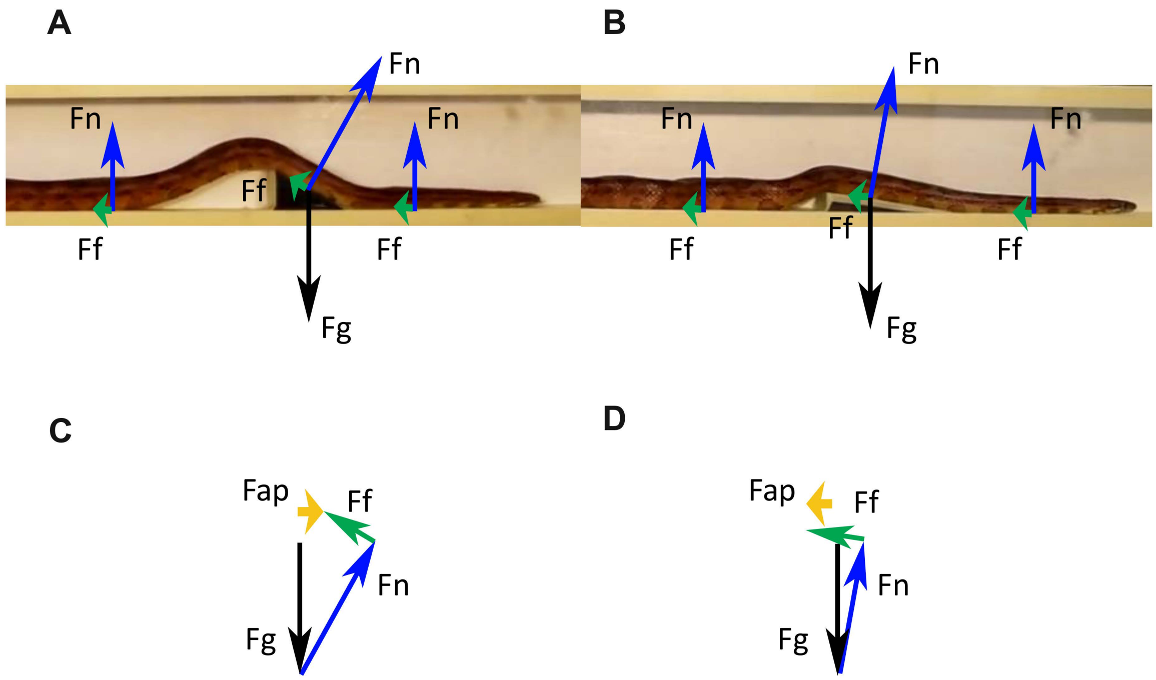
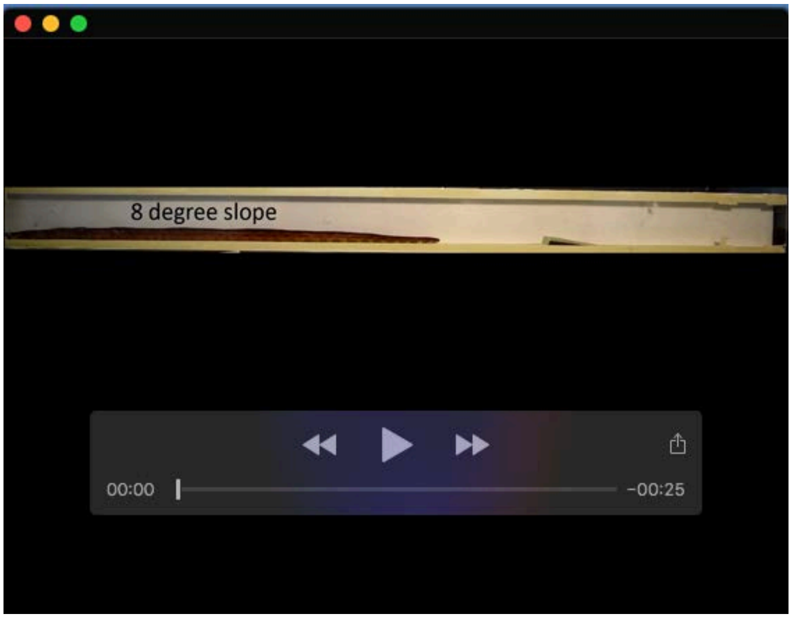
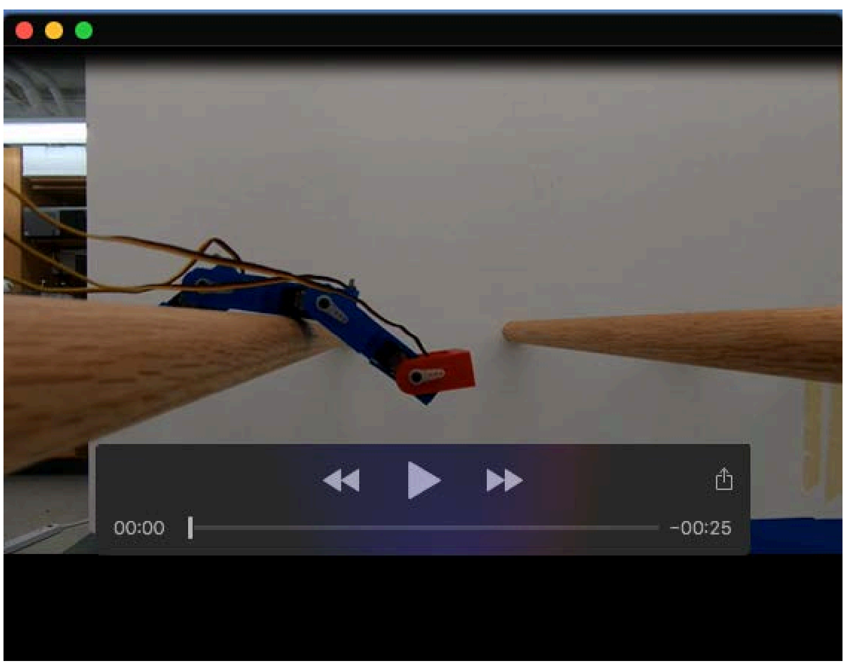


Fig. S4. A) Reaction forces for the corn snake vertically undulating against the 33 wedge at 30º. Fap-anteroposterior force, Ff-frictional force, Fg-gravitational force, Fn-normal 34 force. B) Reaction forces for the corn snake using concertina against the wedge at 10º. C) Body 35 diagram summarizing the forces from A showing a net propulsive force. D) Body diagram 36 summarizing the forces from B showing a net braking force.

Movie 1. Corn snake performing vertical undulations in lateral view across the force-sensing dowel.



Movie 2. Corn snake in lateral view within a tunnel made of PVC boards showing two trials. In the first trial both prior to and while crossing the wedge (sloped at 8°) the corn snake performs concertina locomotion. Following this trial, prior to the wedge (sloped at 30°), the corn snake performs concertina locomotion and transitions to vertical undulations after encountering the wedge.



Movie 3. Snake robot performing vertical undulation in lateral view.

Supplementary Materials and Methods 1. Code used to control the snake robot in the software Python.

```
#Code for the software Python used to control the snake robot.

import serial

import sys

import time

import math

import numpy

import scipy


#variables

x=scipy.arange(0, 35, 1) #time interval for robot, 35 seconds total

a=600 #amplitude

#t=x #'time'

d=0 #phase shift

z=1450 #translation up/down to ‘zero’ servo motors

z1=1500

z2=1475

z3=1425


#Motor0

d0=17.5

#Motor1

d=16
```

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```
#Motor2
d1=14.5
#Motor3
d2=13
#Motor4
d3=11.5
#Motor5
d4=10
#Motor6
d5=8.5
#Motor7
d6=7
#Motor8
d7=5.5
#Motor9
d8=4
#Motor10
d9=2.5
#Motor11
d10=1

#equations separated by motor
y=((a*(numpy.sin(x+d0)))+z1)
```

```
y1=((a*(numpy.sin(x+d)))+z3)

y2=((a*(numpy.sin(x+d1)))+z2)

y3=((a*(numpy.sin(x+d2)))+z)

y4=((a*(numpy.sin(x+d3)))+z)

y5=((a*(numpy.sin(x+d4)))+z)

y6=((a*(numpy.sin(x+d5)))+z1)

y7=((a*(numpy.sin(x+d6)))+z1)

y8=((a*(numpy.sin(x+d7)))+z1)

y9=((a*(numpy.sin(x+d8)))+z1)

y10=((a*(numpy.sin(x+d9)))+z1)

y11=((a*(numpy.sin(x+d10)))+z)



#to read lynxmotion

ssc32 = serial.Serial('/dev/cu.usbserial-A10731HN', 9600, timeout=1.0)


#servo motors information

sin=str(y)

#motor 0

motor='#0 P'

extra='T600 \r'


#motor 1
```

```
motor1='#1 P'

#motor 2

motor2='#2 P'

#motor 3

motor3='#3 P'

#motor 4

motor4='#4 P'

#motor 5

motor5='#5 P'

#motor 6

motor6='#6 P'

#motor 7

motor7='#7 P'

#motor 8

motor8='#8 P'

#motor 9

motor9='#9 P'

#motor 10

motor10='#10 P'

#motor 11

motor11='#11 P'


print("start")
```

```
#delay before running, and motor delay prior to next position
time.sleep(2)

r = y.shape
for robot in range(0,r[0]):
    #motor0
    final=motor+str(y[robot])+' '+extra
    ssc32.write(bytes(final, 'ASCII'))
    time.sleep(.05)

    #motor1
    final=motor1+str(y1[robot])+' '+extra
    ssc32.write(bytes(final, 'ASCII'))
    time.sleep(.05)

    #motor2
    final=motor2+str(y2[robot])+' '+extra
    ssc32.write(bytes(final, 'ASCII'))
    time.sleep(.05)

    #motor3
    final=motor3+str(y3[robot])+' '+extra
```

```
ssc32.write(bytes(final, 'ASCII'))
time.sleep(.05)

#motor4
final=motor4+str(y4[robot])+' '+extra
ssc32.write(bytes(final, 'ASCII'))
time.sleep(.05)

#motor5
final=motor5+str(y5[robot])+' '+extra
ssc32.write(bytes(final, 'ASCII'))
time.sleep(.05)

#motor6
final=motor6+str(y6[robot])+' '+extra
ssc32.write(bytes(final, 'ASCII'))
time.sleep(.05)

#motor7
final=motor7+str(y7[robot])+' '+extra
ssc32.write(bytes(final, 'ASCII'))
time.sleep(.05)
```

```
    #motor8
    final=motor8+str(y8[robot])+' '+extra
    ssc32.write(bytes(final, 'ASCII'))
    time.sleep(.05)

    #motor9
    final=motor9+str(y9[robot])+' '+extra
    ssc32.write(bytes(final, 'ASCII'))
    time.sleep(.05)

    #motor10
    final=motor10+str(y10[robot])+' '+extra
    ssc32.write(bytes(final, 'ASCII'))
    time.sleep(.05)

    #motor11
    final=motor11+str(y11[robot])+' '+extra
    ssc32.write(bytes(final, 'ASCII'))
    time.sleep(.05)



time.sleep(2)
```

```
#return robot to flat position

ssc32.write(bytes('#0 P1500 T500 #1 P1425 T500 #2 P1475 T500 #3 P1450 T500 #4 P1450 T500 #5 P1450 T500 #6 P1500 T500 #7 P1500 T500 #8 P1500 T500 #9 P1500 T500 #10 P1500 T500 #11 P1450 T500 \r', 'ASCII'))


print("end")

ssc32.close()
```