ANALYSIS OF MILLIPEDE'S WALKING MOVEMENT

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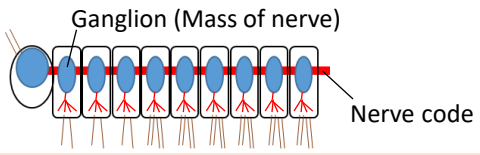
Team 02

Introduction

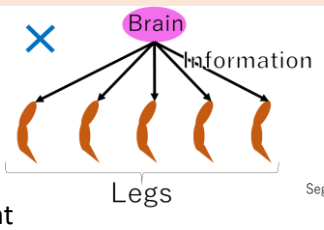
Millipedes have "Ladder nervous system"

- Nerve code runs through the body.
- One ganglion is in each 1 segment.
- Ganglions connect each other by nerve code.

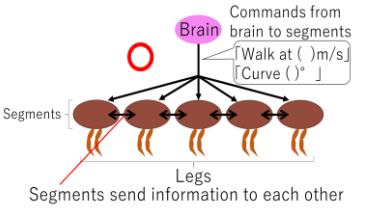


This nervous structure make
"the control in each one segment" able

Controlling all legs individually by one brain
→ Information is centralized , too much ×



Controlling corresponding legs by each one segment
→ Information is decentralized , less ○



Hypothesis : Millipedes control legs by each one segment when they walk

Purpose : To analyze the millipedes' walking to create a millipedes' walking model , that each one segment controls the corresponding legs.

Experimental material

We used ***Archispirostreptus gigas***

Arthropoda phylum
Myriapoda subphylum
millipede class
Spirostreptida order
Spirostreptida family.

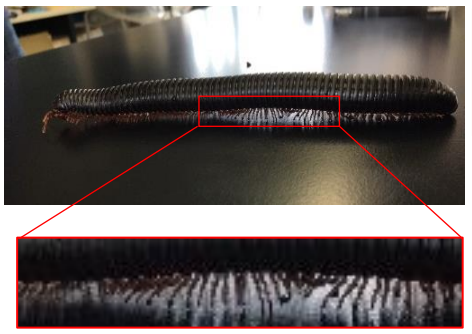
Length : about17cm
Width : about1.5cm
Body segment : 63
Number of legs : 246

Method

We take some videos of its walking.
And measured from movie.
We made a clear aisle and observed from many sides.

Result and Discussion

●Movement



Each legs have the same periodic movement.
"The combination of forth-back movement of joints of legs and bending-stretching of legs"

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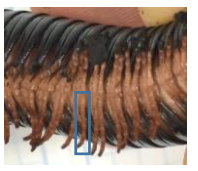
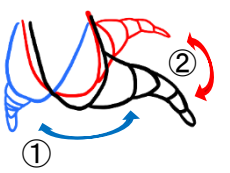
One leg moves with difference of timing from next legs.

Overall movement of legs looks like a wave.





- joints of root of the leg moves like ①, joints of middle of the leg moves like ②, the tip of the leg draws a semicircle
- This movement is repeated periodically

●Structures

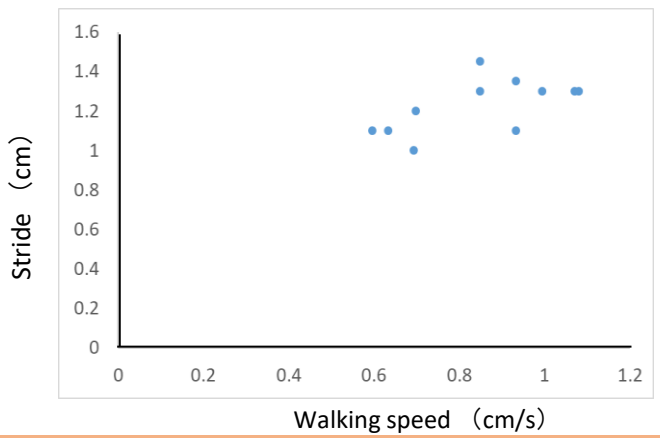
(1)

(2)

(1)There are four legs in one segment

(2)Root of legs

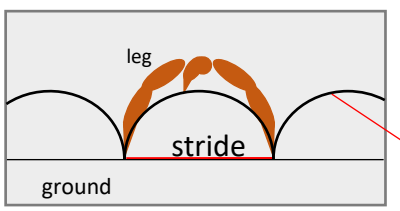
●Speed and Stride



stride did not change so much depending on walking speed

It seems…

walking speed is not controlled by changing the length of movement of legs



Tracing of the tip of a leg

For modeling

the movement of walking can be realized
by constant movement the angle of movement of legs

Conclusion

- Every leg have same periodic movement.
- The speed of legs is adjusted in order to control the walking speed.

} The movement pattern of each joint of legs is constant.

All body segments may have the same movement pattern
Ganglions of each segment control only the corresponding legs.

No need to control the legs individually by one brain.

Future perspective

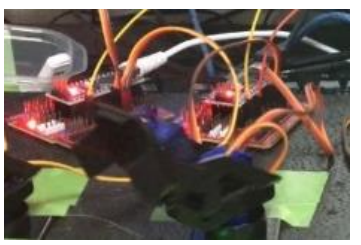
●Each one body segment control the legs.

Model : Use a micro computer in each one segment to control legs.

●Each body segments have the same control type.

Model : All micro computers have same program.

We are going to clear up its program and simulate walking state.



References

1）ヤスデの歩行パターン調節に関する実験的および構成論的検討 Ibaragi University
2）生物の絵巻物を描く！～「生物の歴史」を明らかに～ Tsukuba University , Hachiman Kensuke http://www.biol.tsukuba.ac.jp/cbs/interview-staff/yahata.html
3）東北大学 石黒・加納研究室http://www.cmplx.riec.tohoku.ac.jp/jp/