# BLUE BRAIN PROJECT

## THE ARTIFICIAL BRAIN IN REALITY

PRESENTED BY :
MOHAMMED JASEEM K P
EPAIEEC030
S7 ECE

# INTRODUCTION

- Human Brain,the most valuable creation of God. The man is called intelligent because of the brain.
- We lose the knowledge of a brain when the body is destroyed after death .
- “BLUE BRAIN”-The name of world's first virtual brain. That means a machine can function as human brain.
- First comprehensive attempt to reverse engineer the mammalian brain.
- What would happen if we create an artificial brain and upload the contents of natural brain into it??

# WHERE IT ALL STARTED?

- In July ’05, EPFL and IBM announced a new research initiative- a project to create a functional model of brain
- In ’06, the project created a model of the basic functional unit of the brain- The NeoCorticalColumn(NCC).
- Initial goal of project was completed in DEC ‘06- Simulation of rat’s NCC.
- In Nov ‘07, end of Phase-I was reported.

# WHAT IS A VIRTUAL BRAIN?

- A machine that can function as brain.
- It can take decision.
- It can think.
- It can response.
- It can keep things in memory.

# WHAT IS BLUE BRAIN?

- Scientists are in research to create an artificial brain that can think, respond and take decisions.

- A network of artificial nerves is evolving right now in a Swiss super computer.

- Blue brain will offer a better understanding of human consciousness.

- Focused on biomedical applications.

# COMBINING COMPUTER SCIENCE AND NEURO SCIENCE

The Brain:

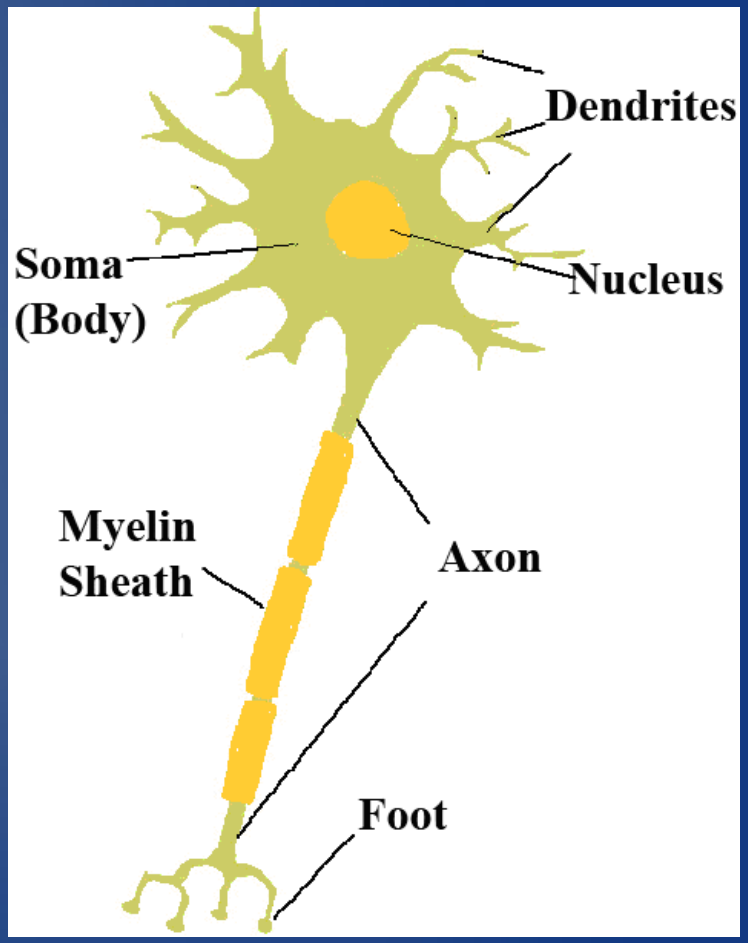
**Cerebral Cortex**

Convoluted grey matter that makes up 80% of the human brain.

Responsible for our ability to think, respond, communicate and plan for the future.

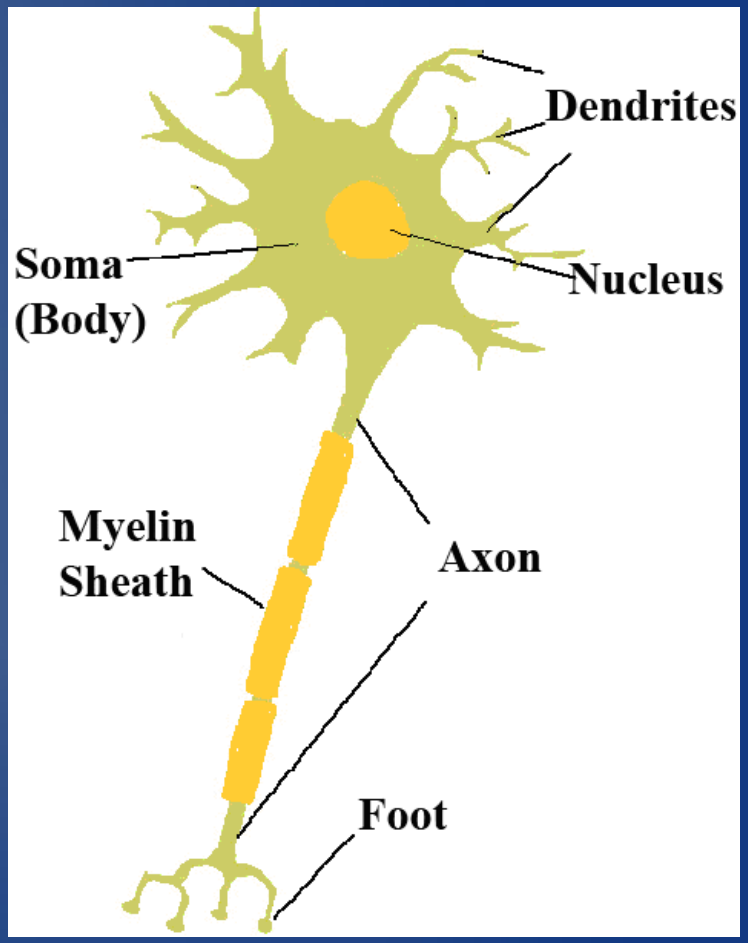
# HUMAN BRAIN

- Biological neuron: Basic component of brain. Connected by dendrites and axons
- Brain process information by sending electrical signals from neuron to neuron.
- Neocortical column(NCC): In cortex, neurons are organized into basic functional units each containing about 10000 neurons.
- Operates much like microcircuits in a computer.



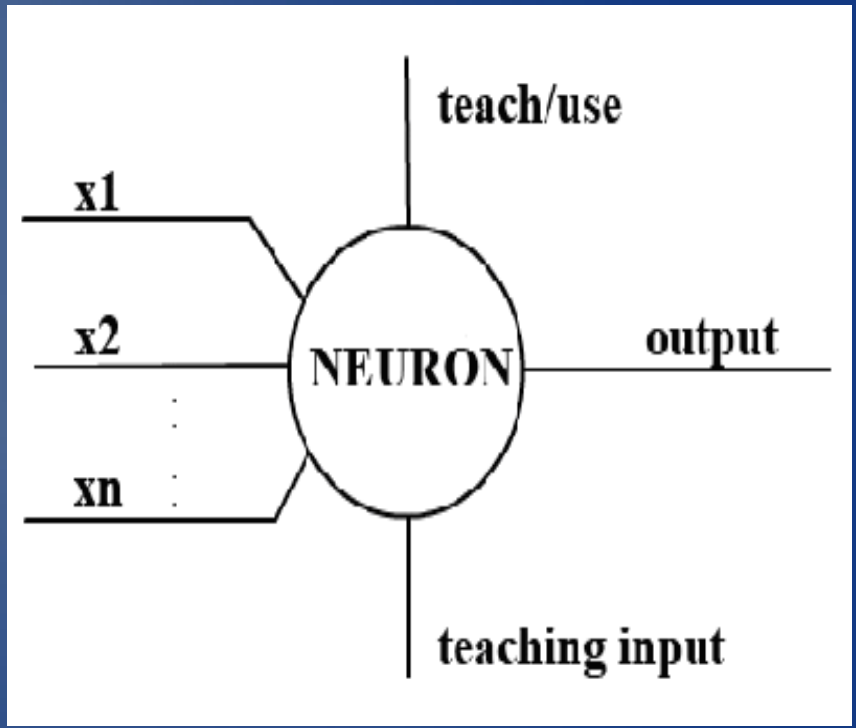
# HUMAN BRAIN

- Biological neuron: Basic component of brain. Connected by dendrites and axons
- Brain process information by sending electrical signals from neuron to neuron.
- Neocortical column(NCC): In cortex, neurons are organized into basic functional units each containing about 10000 neurons.
- Operates much like microcircuits in a computer.



# ARTIFICIAL NEURONS

- 2 modes of operation
- In training mode, the neuron can be trained to fire (or not).
- In using mode, when a taught input pattern is detected at the input, its associated output becomes the current output.



# THREE ASPECTS OF COMPUTATION

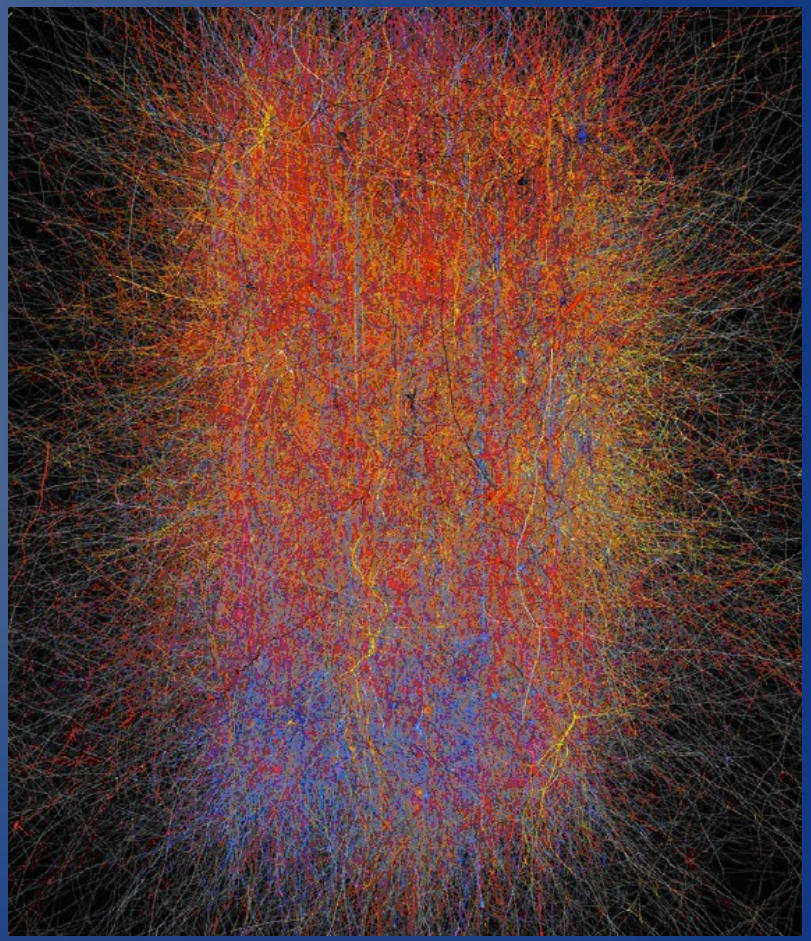
- Neural computing must achieve balance between:

  Processing functions
  Communicating functions
  Storage functions

- **These are the three aspects of computation**

# BUILDING THE MICRO CIRCUITRY

- Modeling neurons and connections: Blue Gene recreates each neurons in NCC and fixes the synapse locations.
- Modeling column: Result of calculations is a re-creation of the NCC.



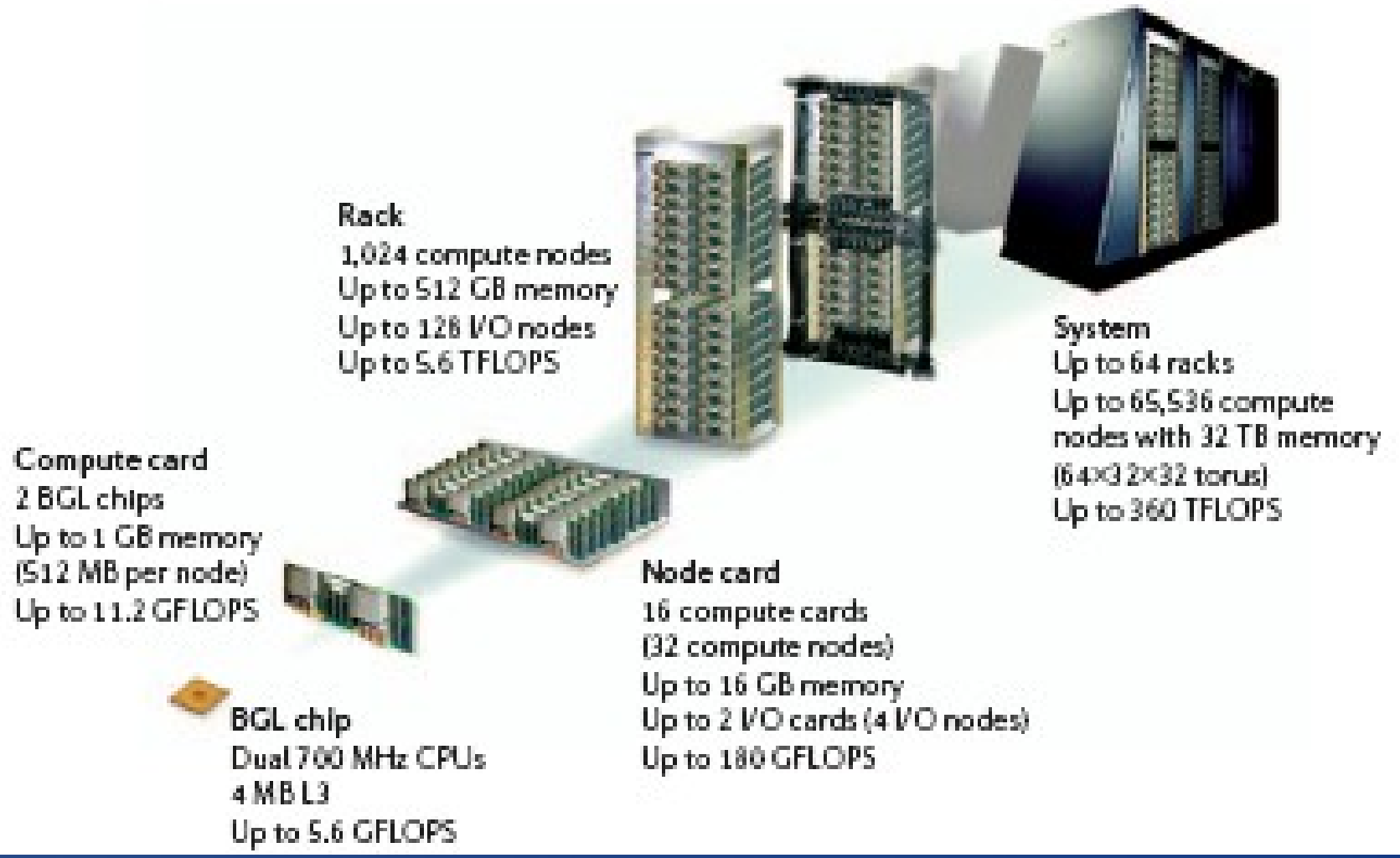
# BLUE GENE

- Built of large number of nodes, each having relatively modest clock rate.
- Each node consists of a single ASIC and 2 GB memory.
- Each processor can perform 4 floating point operations per cycle. Each node contains a second processor for handling message passing.
- Scalable system software that supports efficient executing.

# SIMULATION OF MICRO-CIRCUITRY

- 8192 processors of the Blue Gene are pressed into service.
- Parallel computation solves the complex mathematical equations that govern the electrical activity in each neuron.
- Results are communicated via inter-processor communication.
- Time required to simulate is twice the magnitude than the actual biological time.

# BLUE GENE SUPERCOMPUTER

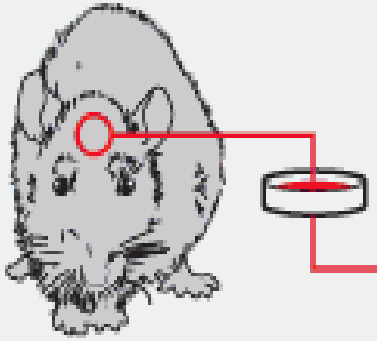


# INTREPRETING THE RESULTS

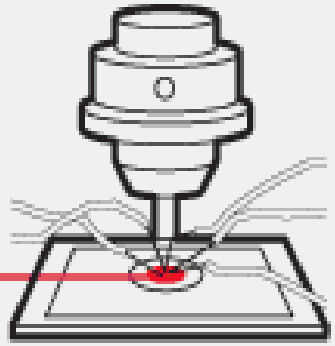
- Analysis of individual neurons must be repeated 1000s of times.
- Visual exploration of circuit is important to analysis.
- Mapping simulation data onto the morphology is for immediate verification.
- NCC has 10,000 neurons.
- When Impulse travels, neurons light up and change colour as they become electrically active.
- Calibration is the second stage of the Blue Brain project.

# EXPERIMENTAL EVIDENCE

Genetic, chemical and electrical information obtained from studies of the rat brain were first used to build an artificial software model, Blue Brain.



A slice of a rat's brain is kept alive in a special liquid solution and prepped for study.



An instrument records the millions of signals exchanged by neurons within a living slice of rat's brain. This data is used to measure the accuracy of the software model, which is constantly refined.

When Blue Brain is stimulated, a supercomputer calculates and displays all the neuronal connections in three-dimensional images such as the one above.

Source/Image: Blue Brain Project

# ADVANTAGES

1. Remembering things without any effort.
2. Making decisions without the presence of a person.
3. Using intelligence of a person after his death. .
4. Understanding the activities of animals.
5. Allowing the deaf to hear via direct nerve stimulation.

# DISADVANTAGES

1. We become dependent upon the computer.
2. Others may use technical knowledge against us.
3. Another fear is found today with respect to human cloning.
4. Computer viruses can pose an increasingly critical threat.

# APPLICATIONS

1. Gathering and testing 100 years of data
2. Understanding neocortical information processing
3. A novel tool for drug discovery for brain disorders
4. A foundation for whole brain simulations

# FUTURE WORKS

- Phase 1 provide the basis for increasing the resolution of the models and expanding the size of the models.
- Information from the molecular and genetic level will be added to the algorithms.
- Insights into how human beings think and remember.
- Shed light on psychiatric disorders.
- If we crack open the secret of how and why the brain does it, could lead to new breed of supercomputers.

# CONCLUSION

- We will be able to transfer ourselves into computers at some point.
- Answers to mental retardation and brain abnormalities can be solved at earlier stages.
- Diseases like Alzheimer's and Parkinson's that rid a person of his dignity could be eradicated totally.

# REFERENCE


- “The Blue Brain Project”Sean Hill, Ph.D.,Henry Markram, Ph.D.,IEEE 2008 transaction
- *Blue Gene http://www.research.ibm.com/*bluegene (2005).
- http://en.wikipedia.org/wiki/Blue_Brain_ProjectThe Blue Brain Project,
- http://bluebrainproject.epfl.ch

# THANK YOU!!!....

## Questions????