Neuroscience of Human Movement
Department of Multidisciplinary
Indian Institute of Technology, Madras

Lecture - 79
Parietal and Premotor cortex - 3

Welcome to this class on Neuroscience of Human Movement. In this class we will discuss Parietal and Premotor cortex. So, this is part 3 of our discussion on this topic.

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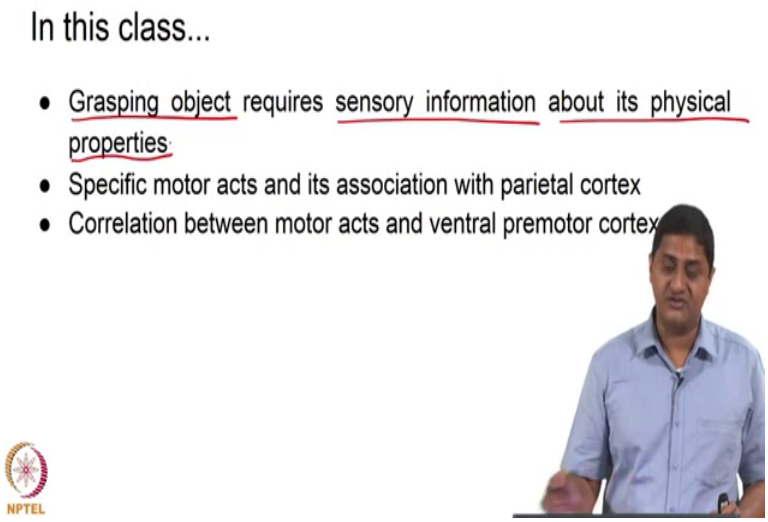

So, in the last class we saw specific regions of the parietal and premotor cortex are responsible for generating movement plans concerning reaching and grasping right. In this class we will see how grasping an object requires sensory information about the physical properties of this object right. For example, the dimension for example, the texture specific motor acts and their association with parietal cortex and the correlation between motor acts and the activity in the ventral premotor cortex right.

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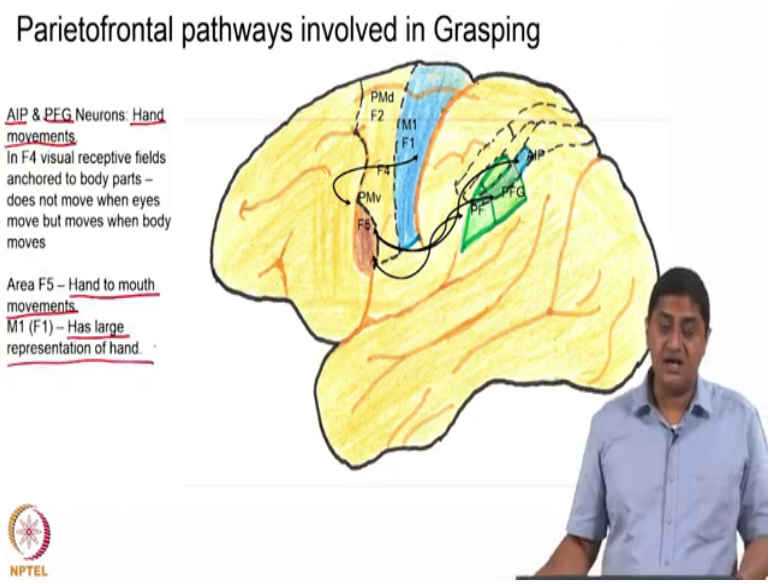

So, we saw in the last class that neurons in a AIP and PFG regions are responsible for hand movements. And in region F4 there are receptive fields anchored to body parts. You know these are active the body moves, but not active in the eyes moves is it not. So; that means, these are body related fields is it not.

And the area F5 also host neurons that have specialized function in coordinating hand to mouth movements right. And also we have already seen in previous class that the primary motor cortex has a disproportionately large representation of the hand.

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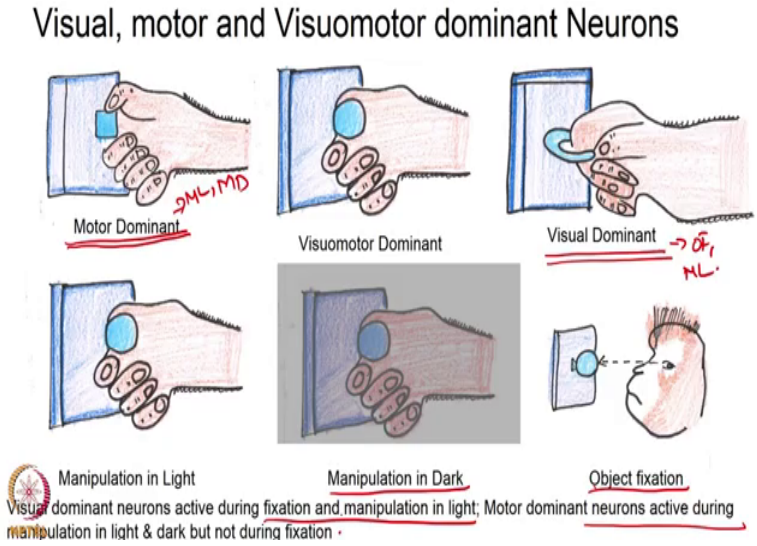

Also what is known is that depending on the task and depending on the type of neuron, there are different classes that can be found. For example, there can be 3 kinds of tasks that they can consider, you can manipulate an object in light. For example, there is light here and in light I am writing with this pen. This is object manipulation in light.

Suppose, this room was dark and I am trying to manipulate this object that is manipulation in dark right, in a dark room I am manipulating the object. Now, a third possibility is that an object is present I am not touching and I am just fixating my eyes on this object right. This involves object fixation, but no real action by the hand right, this is called as object fixation.

Now, there are also neurons that are specialized for each of this function or more than one of these functions. For example, some neurons may be motor dominated. These neurons will be active during manipulation whether during manipulation in light or manipulation in dark, both of these times these neurons will be motor dominant right.

Some neurons will be visual dominant, these neurons are expected to be active during object fixation and manipulation in light. But, since manipulation in darkness does not involve any visual component, these neurons will not be active during manipulation in darkness.

So, these neurons will be active during object fixation and manipulation in light. These neurons will be active during manipulation in light and manipulation in darkness, but not object fixation. The visual mortal dominant neurons are active both during manipulation in light, manipulation in darkness and in object fixation.

So, visual dominant neurons are active during fixation and manipulation in light, motor dominant neurons are active during manipulation in light and dark, but not during fixation right. The visual motor neurons do both of these functions combined. So, there are discrete, separate, distinct sets of neurons that perform each of these functions ok.

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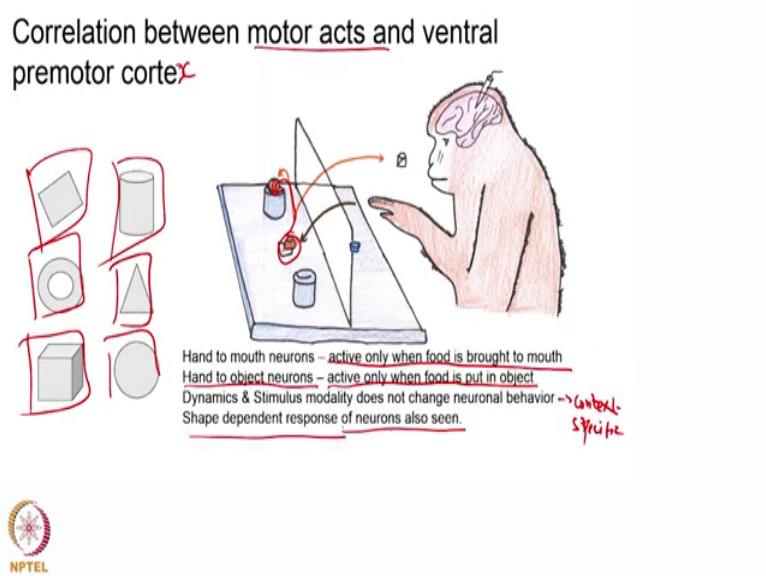

Also important to note is the correlation between specific motor acts and the activity in the premotor cortex ventral premotor cortex right. So, there are neurons that are active only when food is brought to the mouth. Suppose, food is placed in a source and the instruction is to bring the food pellet to the mouth right then a specific set of neurons are active only when the food is brought to the mouth. And hand to object neurons these neurons involve transportation of the food pellet from one place to another destination.

For example, if this is a food source from here transported to a different destination involves hand to object neurons right. So, dynamics and stimulus modality does not change the behavior of neurons; so, essentially not the kinetics or kinematics of the movement that dictate the activity of these neurons. These neurons are active depending on the context right, context specificity, whether the object has to be moved to the mouth or whether the object has to be moved to a different destination depending on that different neurons are active.

So, again this means this is context specific thing, context specific right. Also note that you can have different 3 D objects and will different shapes for example right, different 3 D objects. It has been shown that different sets of neurons are responsive depending on which particular shape is being shown to them ok. So, shape dependent response of specific groups of neurons has also been demonstrated.

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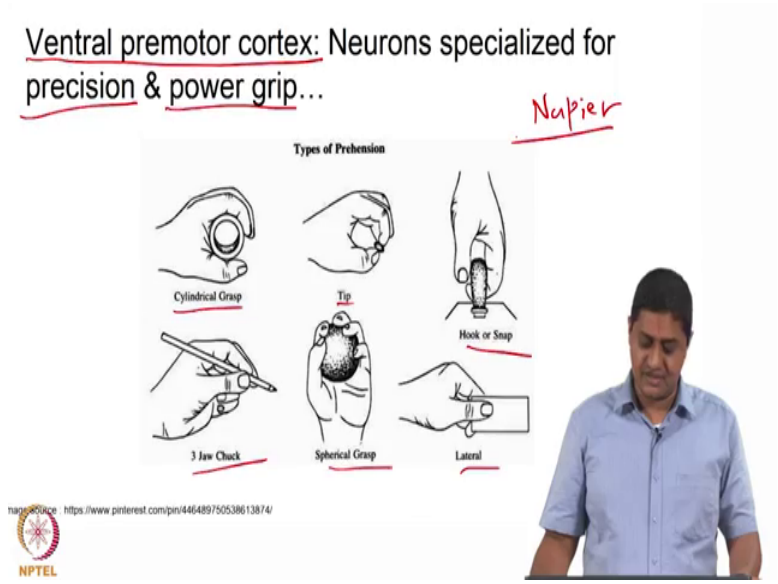

Also another thing to note is that there are neurons that are specialized for precision and power grip, let us define this very briefly. So, precision grip is that when you grip an object between the thumb and a fingertip for example, like this. In this case between the thumb and the middle finger in this case between the thumb and the index finger now right, this is called precision grip or pinch grip. When I use multiple fingers like this this is also called as prismatic precision grip right.

Suppose, I am grasping this object like this right, now I am covering my palm I am surrounding my palm over this object in a cylindrical shape, this is also called as a cylindrical gripper power grip. It turns out that different sets of neurons are specialized or active during different types of grip. So, depending on whether the grip is precision on power right different sets of neurons in the ventral premotor cortex are active. So, this is crucial right, in humans an important ability that distinguishes humans from animals is the ability to manipulate objects, dexterous manipulation of objects is a crucial evolutionary advantage that humans have.

So; that means, these neurons must be more specialized, more well developed in humans is hypothesis that we can have, but the point is that this is present even in animals, even in monkeys. These are different types of graphs that have been shown. Those who are interested can actually check the paper, the book by Napier. It is a book by Napier on and function that discusses all of these types of this ok.

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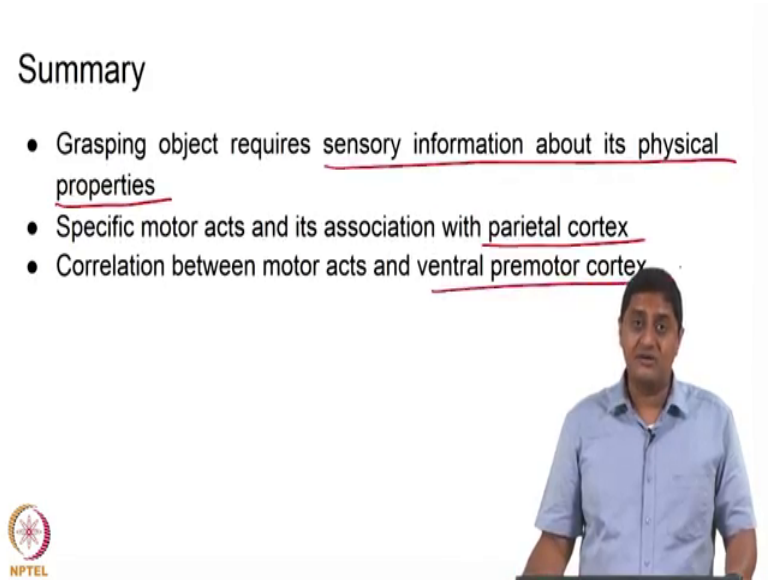

So, in summary grasping an object requires sensory information about it is physical properties. So, what is the object, how big it is, what is the size and this specific motor acts. And it is association with parietal motor cortex and correlation between motor acts and ventral premotor motor cortex activity. So, with this we come to the end of this lecture.

Thank you very much for your attention.