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REVIEW ARTICLE

AN IMPROVED PROTOCOL FOR RAT BRAIN SLICE PREPARATION: A REVIEW

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ABSTRACT:
Brain slices are thin pieces of brain tissue that are used to study the central nervous system. They are commonly prepared from mice, rats, or guinea pigs and offer several advantages over in vivo methods, including precise control over experimental conditions, the ability to examine metabolic parameters and electrophysiological properties without the influence of anaesthetics or other substances, and improved stability for electrophysiological recordings. Brain slices can be used to study a variety of brain regions and are used in research applications such as the study of neuronal membrane properties, synaptic activity, and simple circuit function. However, brain slices also have limitations, such as a lack of certain inputs and outputs present in the intact brain, damage to the slice caused by the slicing process, a limited lifespan, and the potential influence of ischemia resulting from decapitation. The protocol for preparing a rat brain slice includes using materials such as a rat brain, ice-cold cutting solution, a vibratome or slicing apparatus, microscope slides, a dissecting microscope, a scalpel or razor blade, forceps or tweezers, and cover slips.

Key words: *Brain slice, Brain tissue, Vibratome, artificial cerebrospinal fluid*

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INTRODUCTION:

Brain slices are thin pieces of brain tissue that are used in research to study the central nervous system (CNS). They are commonly prepared from mice, rats, or guinea pigs and are prepared by removing the brain from the animal and cutting it into thin slices. Brain slices offer several advantages over in vivo (in a living animal) methods for studying the CNS, including precise control over experimental conditions, the ability to examine metabolic parameters and electrophysiological properties without the influence of anesthetics or other substances, and improved stability for electrophysiological recordings due to the absence of heartbeats and respiration. Brain slices can be used to study a variety of brain regions, including the hippocampus, olfactory cortex, neocortex, cerebellum, hypothalamus, caudate nucleus, amygdala, and others. While brain slices have many benefits, they also have some limitations, such as a lack of certain inputs and outputs present in the intact brain, damage to the slice caused by the slicing process, a limited lifespan, and the potential influence of ischemia resulting from decapitation. Brain slices are used in a variety of research applications, including the study of neuronal membrane properties, synaptic activity, and simple circuit function.

MATERIALS AND METHODS:

To prepare a rat brain slice, following materials are needed.

1. Rat brain

2. Ice-cold cutting solution (e.g., artificial cerebrospinal fluid (aCSF) with sucrose or choline)
3. Vibratome or slicing apparatus.
4. Microscope slides
5. Dissecting microscope
6. Scalpel or razor blade
7. Forceps or tweezers
8. Cover slips

Here is a general protocol for preparing a rat brain slice:

1. Remove the rat brain from the skull and place it in the ice-cold cutting solution.
2. Using a scalpel or razor blade, carefully cut the brain into the desired thickness. For brain slices, a thickness of 300-500 microns is commonly used.
3. Using forceps or tweezers, transfer the brain slice onto a microscope slide.
4. Place a cover slip over the brain slice and press gently to flatten the slice.
5. Observe the brain slice under a dissecting microscope.
6. It is important to keep the brain and cutting solution cold during the slicing process to reduce cell damage. Additionally, it is important to handle the brain slice carefully to avoid tearing or damaging the tissue.

RESULTS AND CONCLUSION:

Rat brain slices are preferred because:

1. Rapid setup employing relatively cheap animals (mouse, rat, guinea pig) in situations where anaesthesia is not required.
2. Due to the preparation's mechanical stability and the absence of heartbeat and breathing pulsations, long-term intracellular recordings are possible.
3. simple control over the preparation's conditions, allowing for the maintenance of appropriate pO2, pC02, pH, and temperature.
4. The ability to directly visualize the slice structure allows for precise placement of the recording and stimulating electrodes at the required locations.
5. Slices lack the blood-brain barrier, so the perfusion medium and its contents can access their extracellular area (ions, transmitters, drugs).

These are a few of these preparations' limitations:

1. Absence of key inputs and outputs that would ordinarily find in a healthy brain.
2. The act of slicing itself results in injury to some areas of the tissue, particularly the top and bottom surfaces.
3. A brain slice has a finite lifespan, and the tissue ages considerably more quickly than the entire animal.
4. It is unclear how decapitation ischemia will affect the slice's viability.
5. Because blood-borne components might not be present in the synthetic bathing medium for the brain slice, they cannot aid in preparation, and the ideal make-up of the bathing solution has not yet been determined.

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