CUBIC
– Animal Tissue-Clearing Reagents –
Technical Guidebook

Provided by
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Graduate School of Medicine
Prof. Hiroki R. Ueda and Tomoyuki Mano

TOKYO CHEMICAL INDUSTRY CO., LTD.
What to Clear?

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Go to the following link for learning how to use CUBIC reagents in video

Scan the QR code or Access the URL http://bit.ly/37IO9TD

Please inquire for pricing and availability of listed products to our local sales representatives.
**Product Introduction**

- **CUBIC-L** (for delipidation and decoloring) 25mL / 100mL [T3740]
- **CUBIC-R+** (for RI matching) 25mL / 100mL [T3741]
- **CUBIC-B** (for decalcification) 25mL / 100mL [T3780]
- **CUBIC-HL** (for delipidation strongly and quenching autofluorescence) 25mL / 100mL [T3781]
- **CUBIC-P** (with perfusion before tissue excision) 25mL / 100mL [T3782]
- **CUBIC-X1** (for expansion) 25mL / 100mL [T3866]
- **CUBIC-X2** (for RI matching with expansion) 25mL / 100mL [T3867]

**Related Products**

- **Mounting Solution (RI 1.520)** [for CUBIC-R+] 50mL [M3294]
- **Mounting Solution (RI 1.467)** [for CUBIC-X2] 50mL [M3292]

• **Basic protocol**;
  Mouse whole-body or animal organ clearing is achieved by using two reagents, CUBIC-L [T3740] for delipidation and CUBIC-R+ [T3741] for RI matching.

• **Optional protocol**;
  The following products can easily clear tissues, such as bones or highly fatty tissues which were previously difficult to clear.
  - CUBIC-B [T3780] for bone
  - CUBIC-HL [T3781] for highly fatty tissues

• **CUBIC-P [T3782]** for mouse perfusion efficiently aids with perfusion fixation.

• **Expansion protocol**;
  The following products can clear tissues with expansion.
  - CUBIC-X1 [T3866] for expansion tissues
  - CUBIC-X2 [T3867] for RI matching with keeping the expanded size of tissues

• **Tissue expansion enables acquisition of images easy.**

• **Preserve the fluorescent protein signals except CUBIC-HL [T3781].**

• **Using light-sheet fluorescent microscopy (LSFM) or confocal laser-scanning microscopy (CLSM) enables the whole-organ / body imaging at a cellular resolution.**

These products were developed by Prof. Hiroki R. Ueda (The University of Tokyo / RIKEN) and are under invention licenses by RIKEN, Japan.

Whole-brain clearing

Whole-body clearing with nuclei staining and immunostaining
**Application**

◆ An adult mouse brain after excision

◆ After pre-treatment step of 4 mL 50% CUBIC-L at room temperature overnight

◆ After delipidation step of 4 mL CUBIC-L at 37°C for 5 days
  (Refresh CUBIC-L on day 1, day 2 and day 4)

◆ After pre-treatment step of 4 mL CUBIC-R+ at room temperature overnight

◆ Observation the sample in Mounting Solution (RI = 1.520) [M3294] after RI matching of 4 mL CUBIC-R+ at room temperature overnight

Each sample of these images is immersed in each reagent.

**Direction for Use : Mouse whole-organ clearing protocol**

<table>
<thead>
<tr>
<th>Process</th>
<th>Reagent</th>
<th>Temp.</th>
<th>Time</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tissue Fix</td>
<td>4% PFA in PBS</td>
<td>4°C</td>
<td>1 day</td>
<td>After perfusion fixation</td>
</tr>
<tr>
<td>Wash x 3</td>
<td>PBS</td>
<td>RT</td>
<td>&gt; 2 hr x 3</td>
<td>Shake gently (Same in following steps). Total 1 day</td>
</tr>
<tr>
<td>(Pre-treatment) 50% CUBIC-L</td>
<td>37°C or RT</td>
<td>6 - 24 hr</td>
<td>Refresh CUBIC-L on day 1, day 2 and every 2 days after day 4.</td>
<td></td>
</tr>
<tr>
<td>Delipidation</td>
<td>CUBIC-L</td>
<td>37°C</td>
<td>&gt; 2 days</td>
<td></td>
</tr>
<tr>
<td>Wash x 3</td>
<td>PBS</td>
<td>RT</td>
<td>&gt; 2 hr x 3</td>
<td>Total 1 day</td>
</tr>
<tr>
<td>(Staining)</td>
<td>Staining reagents*</td>
<td>RT</td>
<td>&gt; 3 days</td>
<td>Optional</td>
</tr>
<tr>
<td>(Wash x 3)</td>
<td>PBS</td>
<td>RT</td>
<td>&gt; 2 hr x 3</td>
<td>Total 1 day, optional</td>
</tr>
<tr>
<td>Pre-treatment</td>
<td>50% CUBIC-R+</td>
<td>RT</td>
<td>1 day</td>
<td>1:1 mixture of water and CUBIC-R+</td>
</tr>
<tr>
<td>RI matching</td>
<td>CUBIC-R+</td>
<td>RT</td>
<td>&gt; 1 day</td>
<td></td>
</tr>
</tbody>
</table>

PFA : paraformaldehyde, RT : room temperature

Light penetrates the organ.

CUBIC-L does not get colored after treatment.
Above points are the signs of end of delipidation.

Total

- CUBIC-L : 14 mL
- CUBIC-R+ : 6 mL

The reagent volumes of the left example is in the case of usage in a 5 mL tube.
Work in a tube whose diameter is a little larger than that of organs and the volume of reagents is half of that of tubes.

* For nuclear staining, use 30 µg/mL Propidium iodide (PI) and 1.5 M NaCl in PBS.
Since the expanded brains are fragile, careful handling is required after the swelling step.

PFA : paraformaldehyde, RT : room temperature

Please inquire for pricing and availability of listed products to our local sales representatives.
Direction for Use: Mouse whole-body clearing protocol

<table>
<thead>
<tr>
<th>Process</th>
<th>Reagent</th>
<th>Temp.</th>
<th>Time</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfusion fixation</td>
<td>PBS</td>
<td></td>
<td></td>
<td>After perfusion, the mouse needs to be perfused with 50% CUBIC-L (1:1 mixture of water and CUBIC-L : water).</td>
</tr>
<tr>
<td>Perfusion</td>
<td>4% PFA in PBS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-treatment</td>
<td>50% CUBIC-L</td>
<td>37°C</td>
<td>&gt; 6 hr</td>
<td>Completely immerse the whole body of the mouse with gentle shaking (same in following steps). Optional</td>
</tr>
<tr>
<td>Delipidation</td>
<td>CUBIC-L</td>
<td>37°C</td>
<td>&gt; 5 days</td>
<td>Refresh CUBIC-L on day 1, day 2 and every 2 days after day 4.</td>
</tr>
<tr>
<td>Wash x 3</td>
<td>PBS</td>
<td>RT</td>
<td>&gt; 2 hr x 3</td>
<td>Total 1 day</td>
</tr>
<tr>
<td>(Staining)</td>
<td>Staining reagents*</td>
<td>RT</td>
<td>&gt; 3 days</td>
<td>Optional</td>
</tr>
<tr>
<td>(Wash x 3)</td>
<td>PBS</td>
<td>RT</td>
<td>&gt; 2 hr x 3</td>
<td>Total 1 day, optional</td>
</tr>
<tr>
<td>Pre-treatment</td>
<td>50% CUBIC-R+</td>
<td>RT</td>
<td>1 day</td>
<td>1:1 mixture of water and CUBIC-R+</td>
</tr>
<tr>
<td>RI matching</td>
<td>CUBIC-R+</td>
<td>RT</td>
<td>&gt; 1 day</td>
<td></td>
</tr>
</tbody>
</table>

Application

◆ Example of usage of adult mouse whole-body clearing
◆ Pre-treatment step of 200 mL 50% CUBIC-L at 37°C overnight
◆ Delipidation step of 200 mL CUBIC-L at 37°C for 5 days
   (Refresh CUBIC-L on day 1, day 2 and day 4)
   ➤ Light penetrates the organ.
   ➤ CUBIC-L does not get colored after treatment.
   Above points are the signs of end of delipidation.

◆ Pre-treatment step of 200 mL CUBIC-R+ at room temperature overnight
◆ RI matching of 200 mL CUBIC-R+ at room temperature overnight

<table>
<thead>
<tr>
<th>Total</th>
<th>CUBIC-L : 700 mL</th>
<th>CUBIC-R+ : 300 mL</th>
</tr>
</thead>
</table>

The reagent volumes of the above example is in the case of usage in a 12 cm x 8 cm x 6 cm container.
Use a tube wherein the whole body can be submerged.

*For nuclear staining, use 30 µg/mL Propidium iodide (PI) and 1.5 M NaCl in PBS.

PFA : paraformaldehyde, RT : room temperature

Please inquire for pricing and availability of listed products to our local sales representatives.
**Direction for Use: Mouse whole-brain clearing with expansion protocol**

<table>
<thead>
<tr>
<th>Process</th>
<th>Reagent</th>
<th>Temp.</th>
<th>Time</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tissue Fix</td>
<td>4% PFA in PBS</td>
<td>4°C</td>
<td>1 day</td>
<td>After perfusion fixation</td>
</tr>
<tr>
<td>Wash x 3</td>
<td>PBS</td>
<td>RT</td>
<td>&gt; 2 hr x 3</td>
<td>Shake gently (Same in following steps). Total 1 day</td>
</tr>
<tr>
<td>Pre-treatment</td>
<td>50% CUBIC-L</td>
<td>37°C</td>
<td>3 hr</td>
<td>1:1 mixture of water and CUBIC-L.</td>
</tr>
<tr>
<td>Delipidation</td>
<td>CUBIC-L</td>
<td>37°C</td>
<td>5 - 14 days</td>
<td>Refresh CUBIC-L every 4 days. 5 days for 1-week-old mice. 7 days for 3-week-old mice. 14 days for 8-week-old and 6-month-old mice</td>
</tr>
<tr>
<td>Wash</td>
<td>PBS</td>
<td>RT</td>
<td>1 day</td>
<td></td>
</tr>
<tr>
<td>Staining</td>
<td>Staining reagents*</td>
<td>RT</td>
<td>3 days</td>
<td></td>
</tr>
<tr>
<td>Wash</td>
<td>PBS</td>
<td>RT</td>
<td>1 day</td>
<td></td>
</tr>
<tr>
<td>Swelling</td>
<td>CUBIC-X1</td>
<td>4°C</td>
<td>2.5 days</td>
<td></td>
</tr>
<tr>
<td>RI matching</td>
<td>CUBIC-X2</td>
<td>RT</td>
<td>1.5 days</td>
<td>Refresh CUBIC-X2 every 12 hours.</td>
</tr>
</tbody>
</table>

**Application**

- Example of usage of mouse brain clearing and expansion
- Pre-treatment step of 3 mL 50% CUBIC-L at 37°C for 3 hours after PBS wash
- Delipidation step of 3 mL CUBIC-L at 37°C for 14 days
  (Refresh CUBIC-L on day 4, day 8 and day 12)
- Wash by PBS, staining by staining reagents and wash by PBS
- Expansion step of 30 mL CUBIC-X1 at 4°C for 2.5 days
- Observation the sample in Mounting Solution (RI = 1.467) [M3292] after RI matching of 40 mL CUBIC-X2 at room temperature for 1.5 days
  (Refresh CUBIC-X2 every 12 hours)

*For nuclear staining, use 30 µg/mL Propidium iodide (PI) and 1.5 M NaCl in PBS.
Since the expanded brains are fragile, careful handling is required after the swelling step.

PFA : paraformaldehyde, RT : room temperature

Magnified view of a transgenic mouse brain after clearing-expansion protocol
### Direction for Use: For the efficient clearing of adult mouse (more than 6-week-old) whole-body or organ samples

<table>
<thead>
<tr>
<th>Process</th>
<th>Reagent</th>
<th>Temp.</th>
<th>Time</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sacrifice</td>
<td>Pentobarbital</td>
<td></td>
<td></td>
<td>Overdose of pentobarbital</td>
</tr>
<tr>
<td>Perfusion fixation</td>
<td>15mL PBS</td>
<td>4°C</td>
<td>1 day</td>
<td>After perfusion of CUBIC-P, the organs are dissected.</td>
</tr>
<tr>
<td>Delipidation</td>
<td>CUBIC-L</td>
<td>37°C</td>
<td>3 - 7 days*</td>
<td>Shake gently (same in following steps).</td>
</tr>
<tr>
<td>Wash</td>
<td>PBS</td>
<td>RT</td>
<td>1 day</td>
<td></td>
</tr>
<tr>
<td>(Staining)</td>
<td>Staining reagents</td>
<td>RT</td>
<td>5 - 7 days</td>
<td>Optional</td>
</tr>
<tr>
<td>(Wash)</td>
<td>PBS</td>
<td>RT</td>
<td>1 day</td>
<td>Optional</td>
</tr>
<tr>
<td>Pre-treatment</td>
<td>50% CUBIC-R+</td>
<td>RT</td>
<td>1 day</td>
<td>1:1 mixture of water and CUBIC-R+</td>
</tr>
<tr>
<td>RI matching</td>
<td>CUBIC-R+</td>
<td>RT</td>
<td>1 - 2 days</td>
<td></td>
</tr>
</tbody>
</table>

*If the immersion period is longer than 4 days, the CUBIC-L should be replaced at least once.

### Direction for Use: For mouse body or tissues including bone

**Clearing examples**

- Mouse head
- Mouse body
- Mouse spine

<table>
<thead>
<tr>
<th>Process</th>
<th>Reagent</th>
<th>Temp.</th>
<th>Time</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tissue fixation</td>
<td>4% PFA in PBS</td>
<td>4°C</td>
<td>1 day</td>
<td></td>
</tr>
<tr>
<td>Delipidation</td>
<td>CUBIC-L</td>
<td>37°C</td>
<td>3 - 7 days*</td>
<td>Shake gently (same in following steps).</td>
</tr>
<tr>
<td>Wash</td>
<td>PBS</td>
<td>RT</td>
<td>1 day</td>
<td></td>
</tr>
<tr>
<td>Decalcification</td>
<td>CUBIC-B</td>
<td>37°C</td>
<td>5 - 7 days</td>
<td>The CUBIC-B should be refreshed at least once.</td>
</tr>
<tr>
<td>Wash</td>
<td>PBS</td>
<td>RT</td>
<td>1 day</td>
<td></td>
</tr>
<tr>
<td>Delipidation</td>
<td>CUBIC-L</td>
<td>37°C</td>
<td>2 - 4 days</td>
<td></td>
</tr>
<tr>
<td>Wash</td>
<td>PBS</td>
<td>RT</td>
<td>1 day</td>
<td></td>
</tr>
<tr>
<td>(Staining)</td>
<td>Staining reagents</td>
<td>RT</td>
<td>5 - 7 days</td>
<td>Optional</td>
</tr>
<tr>
<td>(Wash)</td>
<td>PBS</td>
<td>RT</td>
<td>1 day</td>
<td>Optional</td>
</tr>
<tr>
<td>Pre-treatment</td>
<td>50% CUBIC-R+</td>
<td>RT</td>
<td>1 day</td>
<td>1:1 mixture of water and CUBIC-R+</td>
</tr>
<tr>
<td>RI matching</td>
<td>CUBIC-R+</td>
<td>RT</td>
<td>1 - 2 days</td>
<td></td>
</tr>
</tbody>
</table>

*If the immersion period is longer than 4 days, the CUBIC-L should be replaced at least once.

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Please inquire for pricing and availability of listed products to our local sales representatives.
autofluorescent signals, delipidation should be finished within approximately one week. The autofluorescence of cerebral cells decreased as the delipidation period increased. In order to preserve sufficient beyond 2 weeks, the subsequent delipidation is recommended to be done at a lower temperature or in CUBIC-L | T3740).

The immersion period is based on the sample size. As delipidation progresses, the apparent opacity inside the sample disappears. During delipidation, the CUBIC-HL should be refreshed at least once. If delipidation needs to be prolonged **The immersion period is based on the sample size. As delipidation progresses, the apparent opacity inside the sample disappears. During delipidation, the CUBIC-HL should be refreshed at least once. If delipidation needs to be prolonged beyond 2 weeks, the subsequent delipidation is recommended to be done at a lower temperature or in CUBIC-L [T3740].

**The immersion period is based on the sample size. As delipidation progresses, the apparent opacity inside the sample disappears. During delipidation, the CUBIC-HL should be refreshed at least once. If delipidation needs to be prolonged beyond 2 weeks, the subsequent delipidation is recommended to be done at a lower temperature or in CUBIC-L [T3740].
The autofluorescence of cerebral cells decreased as the delipidation period increased. In order to preserve sufficient

**The immersion period is based on the sample size. As delipidation progresses, the apparent opacity inside the sample**

<table>
<thead>
<tr>
<th>Process</th>
<th>Reagent Temp.</th>
<th>Time</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wash</td>
<td>RT</td>
<td>1 day</td>
<td></td>
</tr>
<tr>
<td>Fixation</td>
<td>RT</td>
<td>1 day</td>
<td></td>
</tr>
<tr>
<td>Wash</td>
<td>RT</td>
<td>1 day</td>
<td></td>
</tr>
<tr>
<td>Fixation</td>
<td>RT</td>
<td>1 day</td>
<td></td>
</tr>
<tr>
<td>Wash</td>
<td>RT</td>
<td>1 day</td>
<td></td>
</tr>
<tr>
<td>Process</td>
<td>RT</td>
<td>1 day</td>
<td></td>
</tr>
</tbody>
</table>

**Q&A : About Staining Reagents**

**Q: What kind of staining reagents can be used?**
A: a) Antibodies: direct fluorescent-labeled antibodies are preferred. For example, the antibodies are diluted adequately in PBS containing both 0.5% Triton X-100 and 0.01% NaN₃.
b) Nuclei staining reagents: propidium iodide can be used. Propidium iodide is diluted to 10 μg/mL with 0.1 M phosphate buffer (pH 7.4), containing 0.5 M NaCl.

**Q: Can antibodies from my laboratory be used?**
A: Some proteins do not change their antigenicity during fixation or tissue-clearing procedures. However, this is not conformed for all the proteins. It is recommended to initially test the antibodies you are already using.

**Q: Can fluorescent-labeled secondary antibodies be used?**
A: We do not have information about protocols using secondary antibodies. It takes significant amounts of time for the two-step treatment with both primary and secondary antibodies. Therefore, we recommend directly labeling your primary antibody with fluorescent reagents.

**Q: What kind of fluorescent proteins can be used?**
A: We assessed the retention of fluorescence intensity in GFP. Some fluorescent proteins, such as, EGFP, EYFP, mCherry, and mKate2, have been confirmed to retain their fluorescence signals (Cell 2014, 157, 726-739.)

**Q&A : During Clearing Steps**

**Q: What kind of container is suitable?**
A: Any container that is slightly larger than the organism specimen being cleared is suitable. For mouse organ clearing, a container that is slightly bigger than the organ itself is recommended because the organ may expand during the clearing procedure. CUBIC products are aqueous-based reagents, thus they can be used safely with any laboratory plasticware such as polypropylene or polyethylene.

**Q: Does tissue swell? If yes, will this influence the experiment in any way?**
A: The tissue or organs may expand during the clearing; However, it has been reported that relative cell position remains the same. Thus, expansion is linear and uniform.

**Q: Could the sample fixation step be omitted because the organs undergo the clearing steps as soon as they are excised?**
A: In the samples without fixation, the structure of cells may be destroyed, thus, they should be fixed before clearing steps.

**Q: Is it possible to clear the samples after they were excised and fixed?**
A: The samples which were soaked in fixing solution for several weeks or which are stored at -80°C for several months after fixation can still get cleared.

**Q: Can paraffin embedded samples be sectioned and get cleared by CUBIC?**
A: Paraffin embedded samples can get cleared by CUBIC after thermal deparaffinization. However, samples should not be sectioned to a few μm thick. After getting cleared, samples become fragile and a few μm thick of samples cannot be treated. Therefore, samples should be sectioned by razor or something to one mm thick or thicker and then treated under CUBIC. The following reference mentions the way to clear samples in detail. CUBIC pathology: three-dimensional imaging for pathological diagnosis
DOI: https://doi.org/10.1038/s41598-017-09117-0

**Q: What quantity of these reagents are required for tissue clearing?**
A: For mouse whole-body clearing, the volume of reagents used must be sufficient to submerge the entire specimen. For example, for the whole-body clearing of a mouse, 200 to 400 mL of CUBIC-L and 100 to 200 mL of CUBIC-R+ are needed. For mouse tissue clearing, the volume of reagents needed is half the volume of the organ being cleared. For example, 20 to 40 mL of CUBIC-L and 10 to 20 mL CUBIC-R+ are needed.
Q: The clearing of organs or bodies was interrupted and did not occur successfully.
A: There are a few possible reasons. Consider the following troubleshooting options.
   a) The pH of PFA solution for fixing organs or bodies is too high.
      When the pH is more than 8, organs and bodies become over-fixed and are less cleared, thus,
      the pH should be adjusted between 7 – 7.5.
   b) Delipidation is incomplete.
      Samples are immersed in CUBIC-L with gentle shaking at 37 °C for 2 – 5 days or more, and fresh CUBIC-L
      should be used daily.
   c) Clearing is incomplete.
      The clearing time period can be extended. Additionally, consider replacing and using a fresh CUBIC-R+
      solution.

Q: How long does it take to delipidate samples?
A: Approximately 3 days are required to delipidate the lung, intestine, pancreas and spleen of an adult mouse,
   and approximately 5 days to delipidate the heart, brain, liver and kidney.

Q&A : After Clearing Samples

Q: How should the reagents be disposed of following use?
A: Please dispose of the reagents according to the regulations of your institution. Reagents used to soak animal
   or organ samples are typically treated as medical waste. The unused CUBIC-L, and CUBIC-R+ reagents are non-
   flammable waste liquids. Please refer to the included package insert for reagent descriptions and constituencies.

Q: How should clearing samples be stored?
A: Clearing samples can be stored at room temperature in CUBIC-R+ or CUBIC-X2. CUBIC-R+ and CUBIC-X2
   contain many solutes and a little water as a solvent. Thus, the samples should be stored sealed by parafilm or
   other means to prevent reagents from evaporation. The agarose gel embedding sample can also be stored at
   room temperature.

   [How to embed in agarose gel]
   Add agarose powder to the used CUBIC-R+ to a final concentration of 2%(w/v) in a tube, and dissolve it by heat.
   Embed samples into the mixture before gelation, and prepare the gel by cooling it. This agarose gel can be stored
   at room temperature, and if required, the head of the tube can be cut and the gel pushed out. The surface of the
   gel becomes dry and white when it is pushed out; therefore, it should be used immediately after pushing.

Q: Clearing samples cannot be observed well.
A: Light-sheet fluorescent microscopy (LSFM) or confocal laser-scanning microscopy (CLSM) is recommended for
   the observation of the samples. Clearing samples become gel-like and it may be difficult to cut them into thin
   slices. The samples should be observed in Mounting Solution (RI = 1.520) [M3294] or Mounting Solution
   (RI = 1.467) [M3292] with objective lens which are available of these RIs.

Q: What is the refractive index (RI) of CUBIC reagents?
A: The RI of CUBIC-R+ is 1.520 and that of CUBIC-X2 is 1.467. They should not be mixed with other solvents
   such as water in order to change their RIs.

Q: CUBIC-1, CUBIC-2 have been described in some papers, are they the same as
   CUBIC-L, CUBIC-R+?
A: CUBIC-1, CUBIC-2 differ from CUBIC-L, CUBIC-R+ in terms of their clearing ability, as CUBIC-L, CUBIC-R+ is
   superior. CUBIC-1 and CUBIC-L play the same role in delipidation and decoloring, and CUBIC-2 and CUBIC-R+
   play the same role in RI matching. CUBIC-R also differs from CUBIC-R+. CUBIC-R is composed of nicotinamide
   and CUBIC-R+ is composed of N-methylnicotinamide. CUBIC-R+ is superior to CUBIC-R in terms of maintaining
   fluorescent signals.

*The clearing or staining result differ according to the samples or staining reagents. Please examine the treatment time or the concentration of staining reagents.
CUBIC Pathology: Three-dimensional Imaging for Pathological Diagnosis

Application to Pathological Tissue Diagnosis
CUBIC pathology: three-dimensional imaging for pathological diagnosis

References

Using CUBIC-X1 and CUBIC-X2, Mouse Brain Expansion
A three-dimensional single-cell-resolution whole-brain atlas using CUBIC-X expansion microscopy and tissue clearing

[Immunohistochemistry after CUBIC protocol]
Chemical Landscape for Tissue Clearing based on Hydrophilic Reagents

Mouse Whole Body, Brain, Lung Clearing
Whole-Body Profiling of Cancer Metastasis with Single-Cell Resolution

Mouse Brain, Marmoset Brain Clearing
Whole-Brain Imaging with Single-Cell Resolution Using Chemical Cocktails and Computational Analysis

With CUBIC Perfusion, Mouse Whole Body, Heart, Lung, Kidney, Liver Clearing
Whole-Body Imaging with Single-Cell Resolution by Tissue Decolorization

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