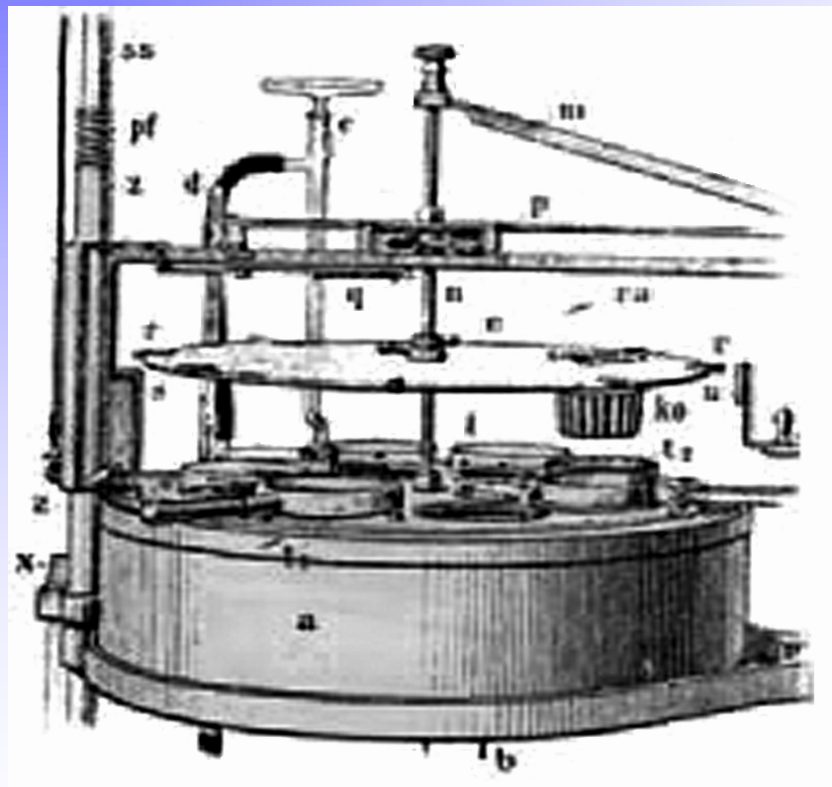
Cooking in the 21st Century

Warren Dellow

In 100 years very little has changed

* G Arendt (1909) Apparat zur selssttaetigen Fixierung und Einbettung mikroskopischer Praeparate, Munchen. med. Wochschr. 56:2226-2227



First Semi- Automatic processor 1909

QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

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Sakura Tissue-Tek VIP 5

Peloris VisionBiosystem

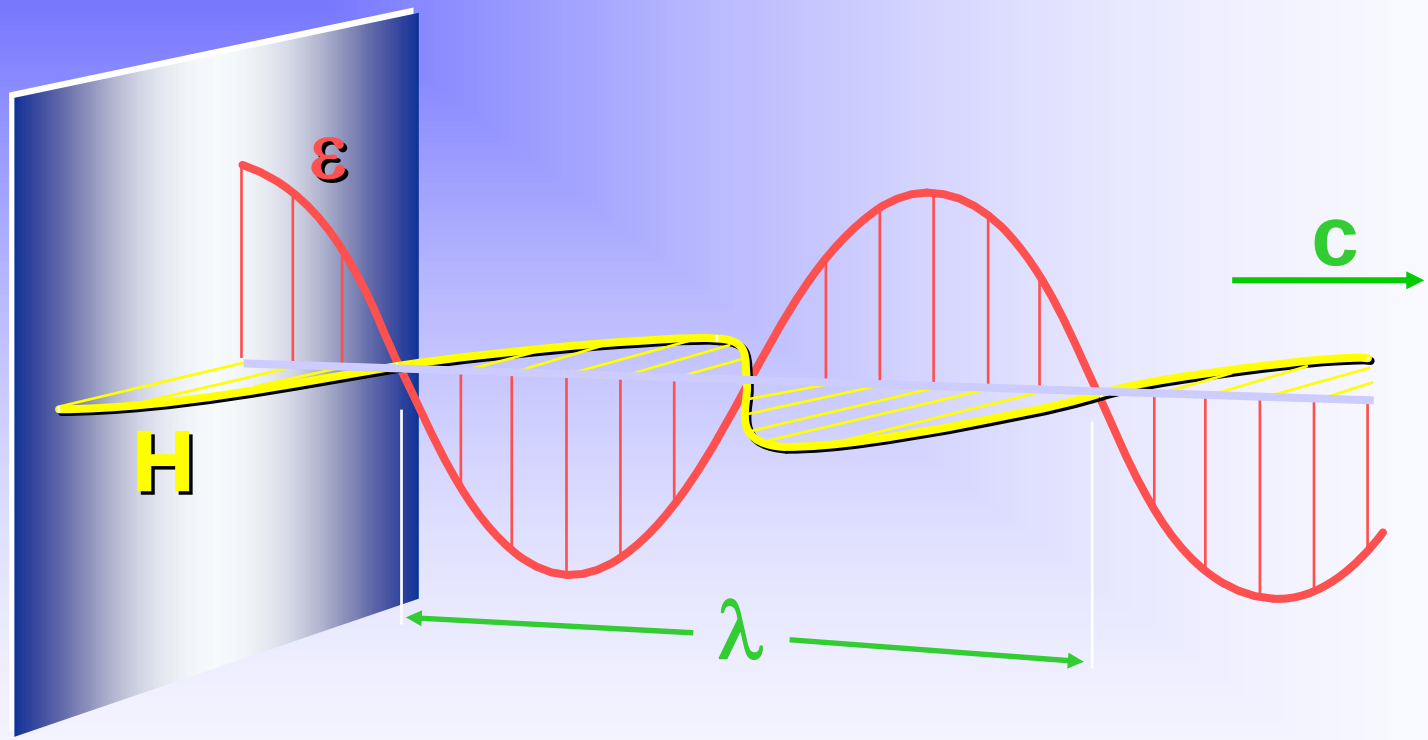
Conventional Processing Times

- Biopsies - approx. 2.5 hours
- Normal cassette processing (3 - 5mm) - approx 4 - 6 hours [Usually overnight]
- Fatty Tissue - 8 - 14 hours [Usually overnight]
- Cases reported in 24 hours to 15 days (2 - 7 days for most cases in New Zealand.)

The Goal

- Speed up processing
- Same day reporting of most Anatomical Pathology cases
- Biopsies processed in 30 - 40 minutes
- 3mm tissues in <3 hours
- 1 or 2 reagents plus wax
- No Xylene
- Reuse the wax
- No daily cleaning
- Suitable for molecular pathology (DNA **and** RNA targets.)

Theory of microwave heating - How and why does it work?



Microwaves are electromagnetic radiations

Theory of microwaves heating

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Energy

- **Microwaves are not ionising radiation**
- **Microwaves energy is largely below the energy necessary to break the bonds of common organic molecules**

Microwaves radiation (2.450 MHz) quantum energy (eV)	
	0.0016
Chemical bond energy (eV)	
H-OH	5.2
CH3-CH3	3.8
Hydrogen bond (water)	0.21

Theory of microwave heating

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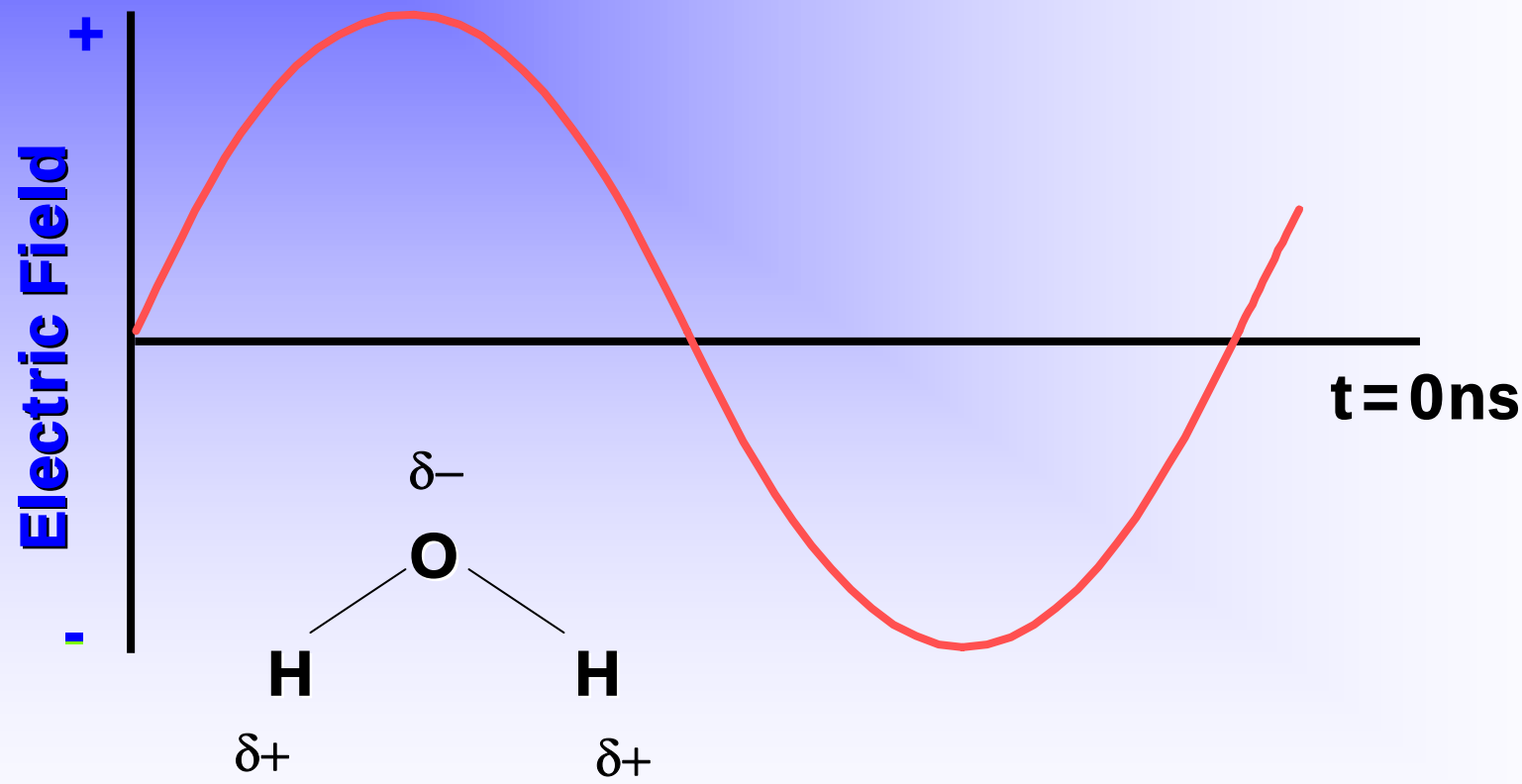
- **Wavelengths range from 1mm to 1m**
- **Frequency allowed for commercial, medical and scientific applications:**

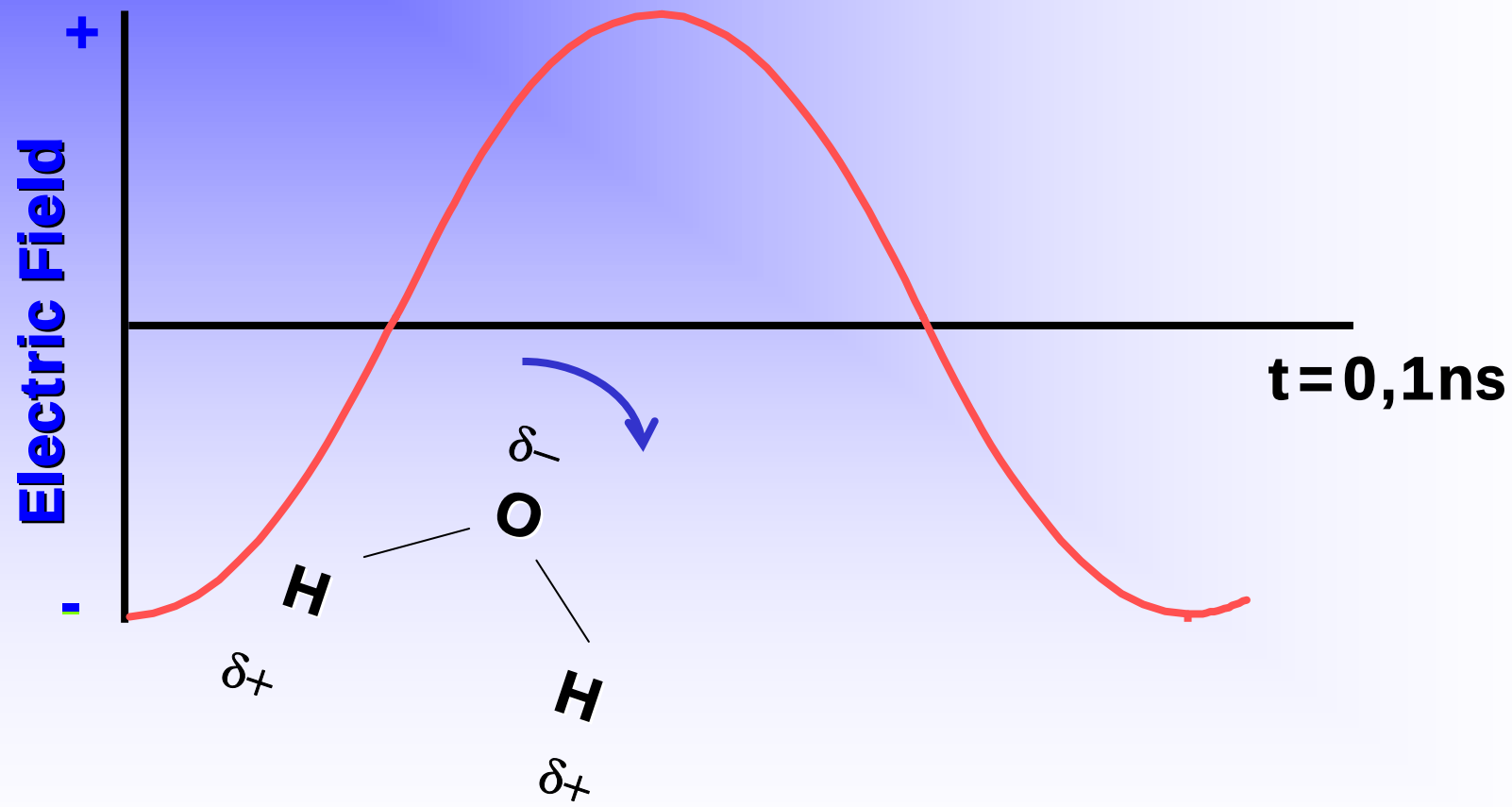
  2.450 MHz (12.2 cm wavelength)

- **Heating is caused by**
  - **Dipole rotation**
  - **Ionic migration**

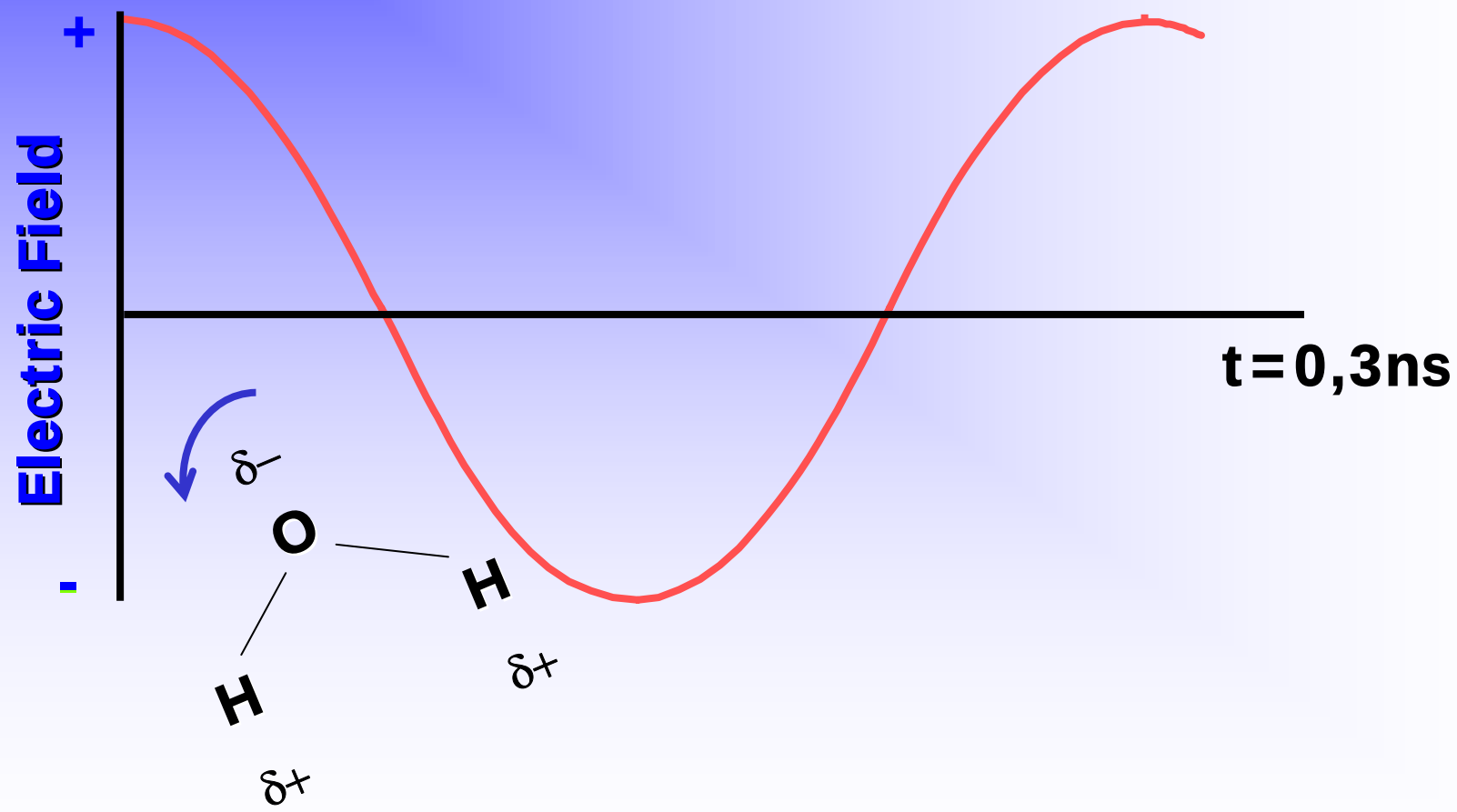
Dipole rotation



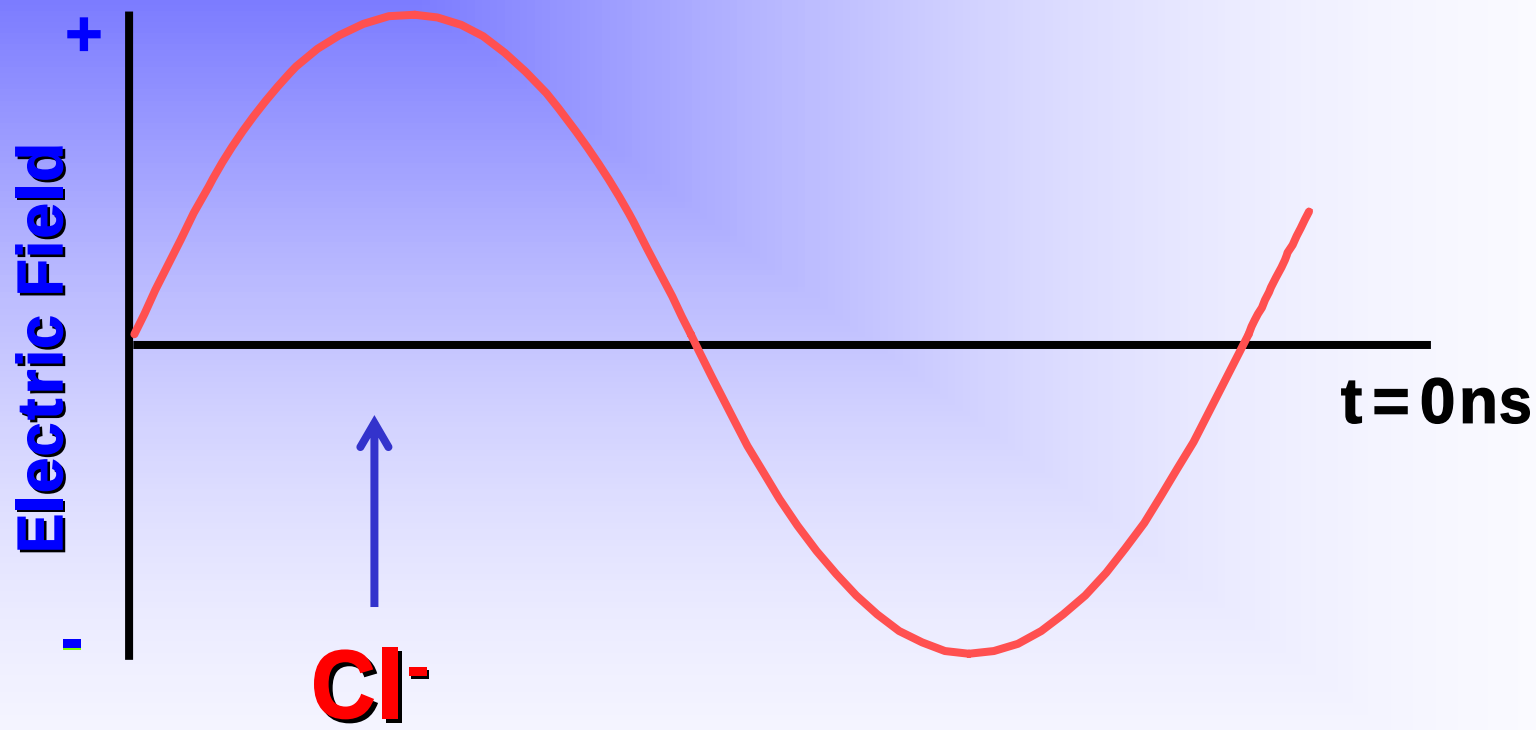
Dipole rotation



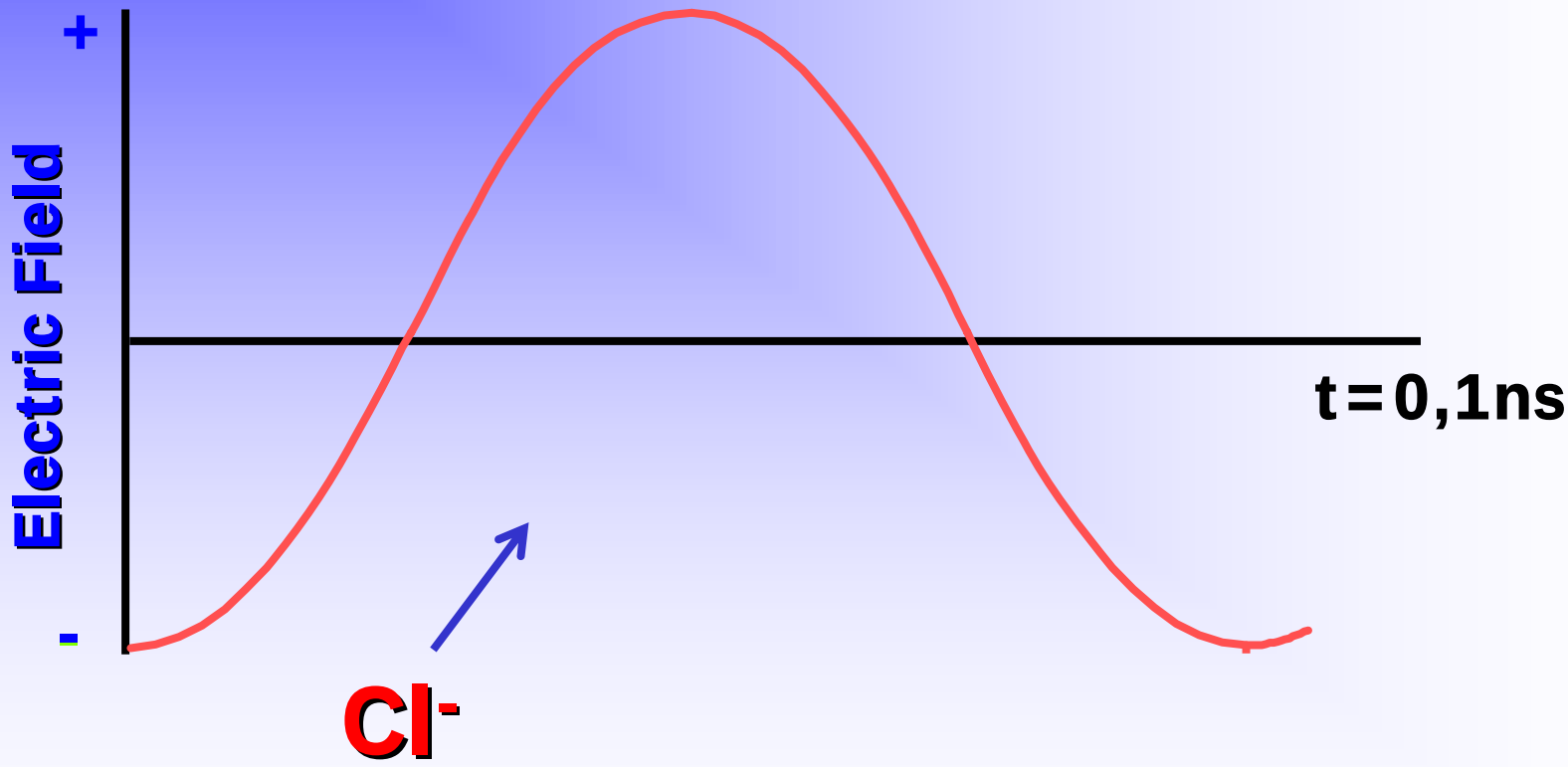
Dipole rotation



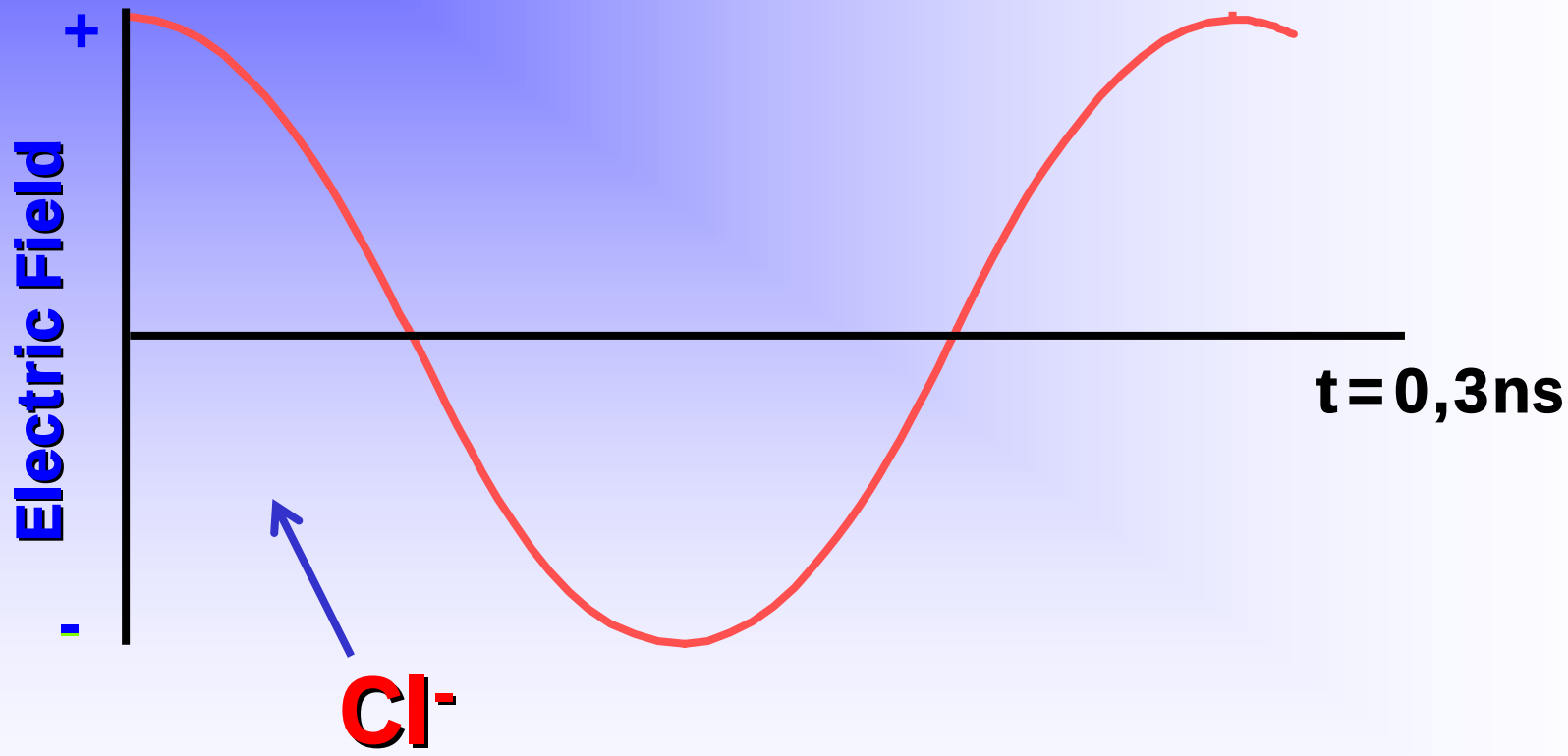
Ionic migration



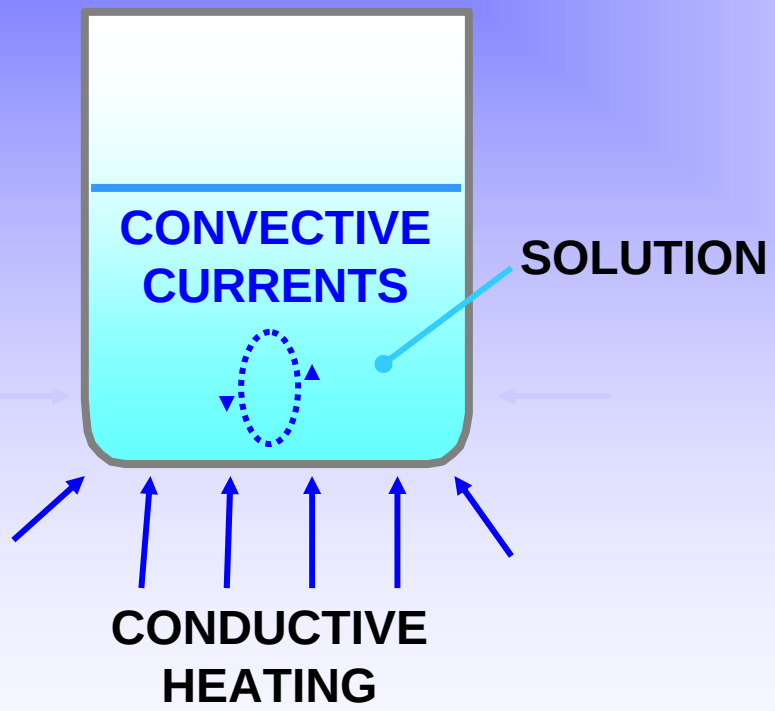
Ionic migration



Ionic migration

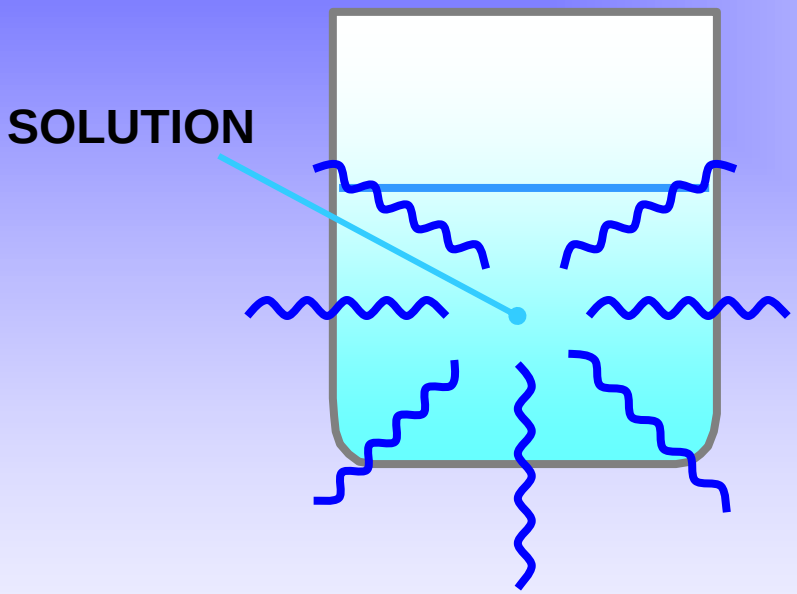


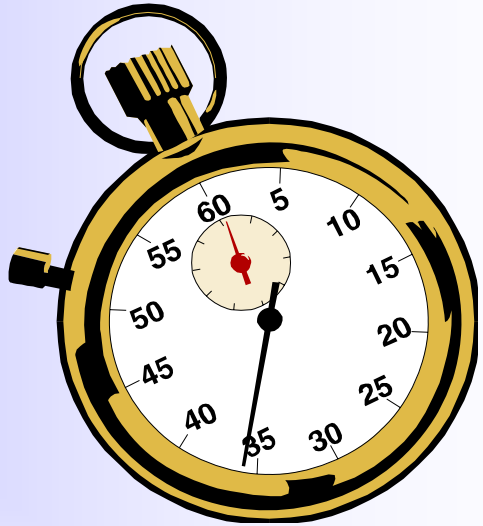
Conventional Heating



- The temperature of the outside surface of the vessel is in excess of the boiling point of the solution
- Container is heated first then the solution

Microwave heating





Shorter Reaction Times

Solution is heated first

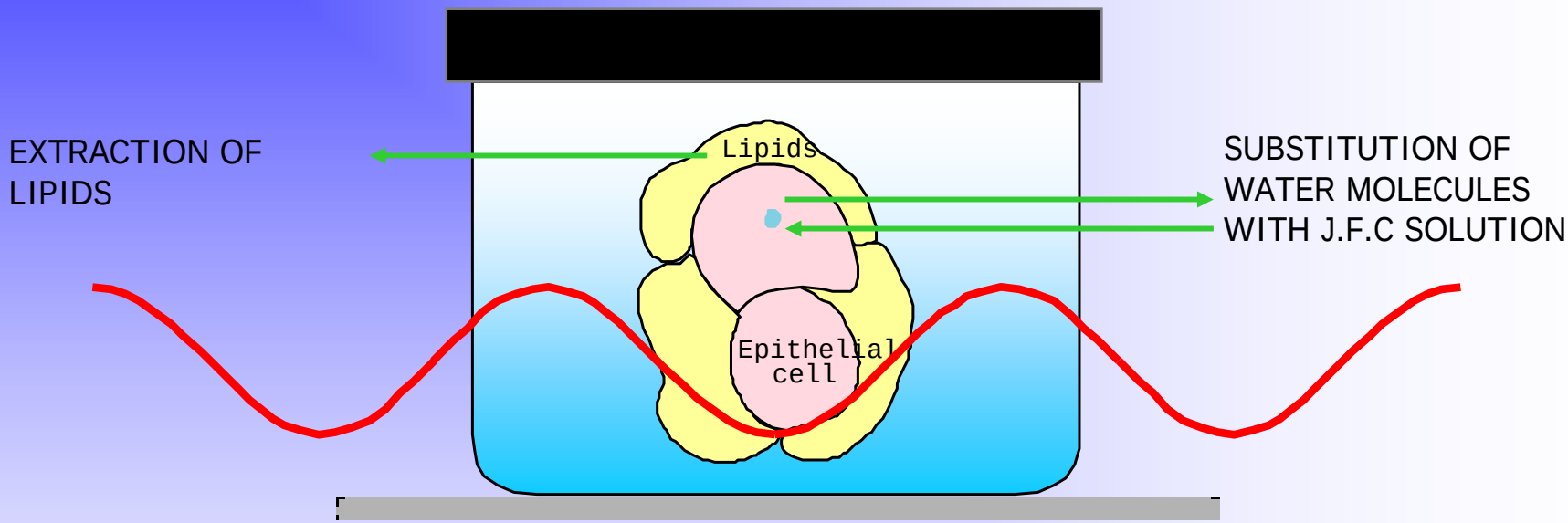
Applying this to Tissue Processing

- The secret is to manage the temperature not the microwave power setting.
- Use pulses of power to create heat (temperature increase or maintain temperature) along a pre-programmed time line.
- Most microwave ovens have power setting controls but no way of accurately monitoring temperature inside a microwave vessel.
- Infrared thermal sensors allow accurate, remote temperature measurement of the contents of a microwave vessel.

Microwave Program

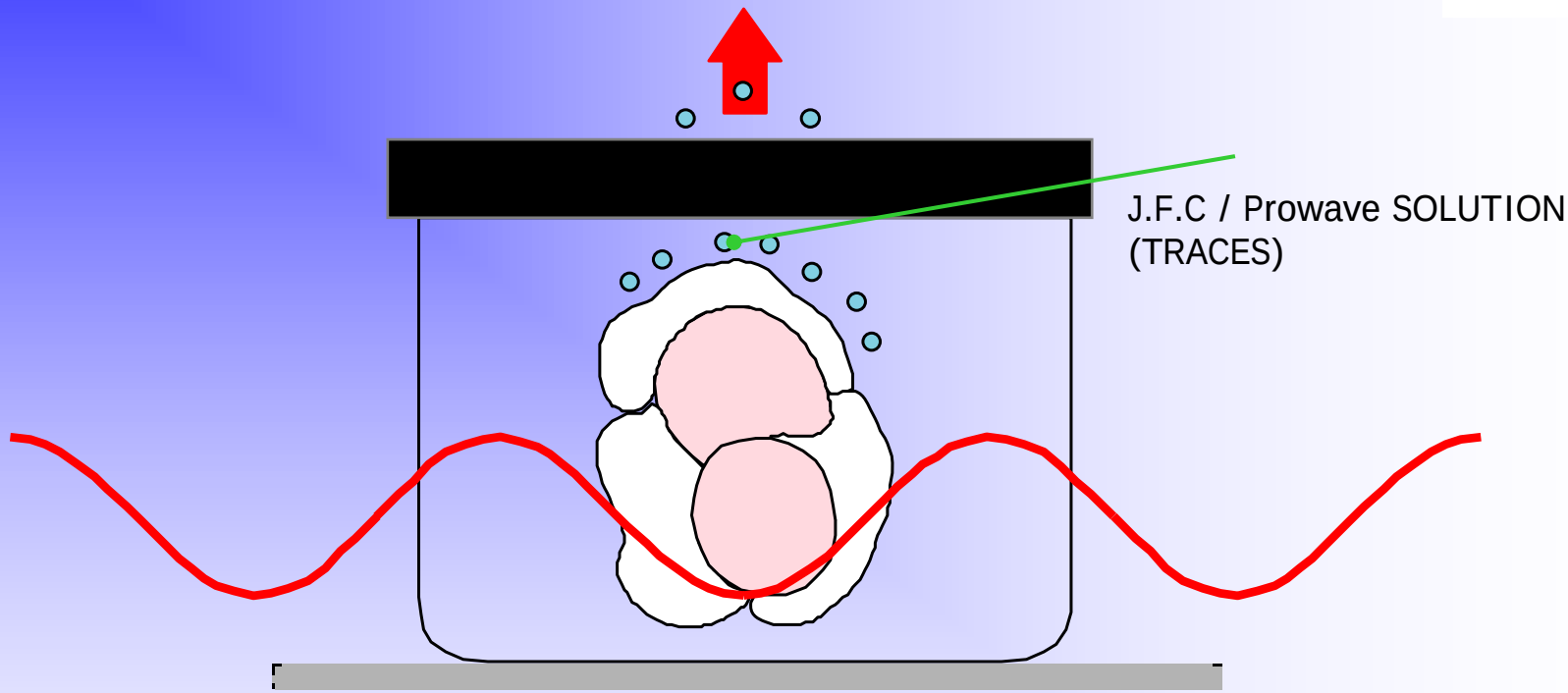
QuickTime™ and a
TIFF (Uncompressed) decompressor
are needed to see this picture.

Histoprocessing step 1



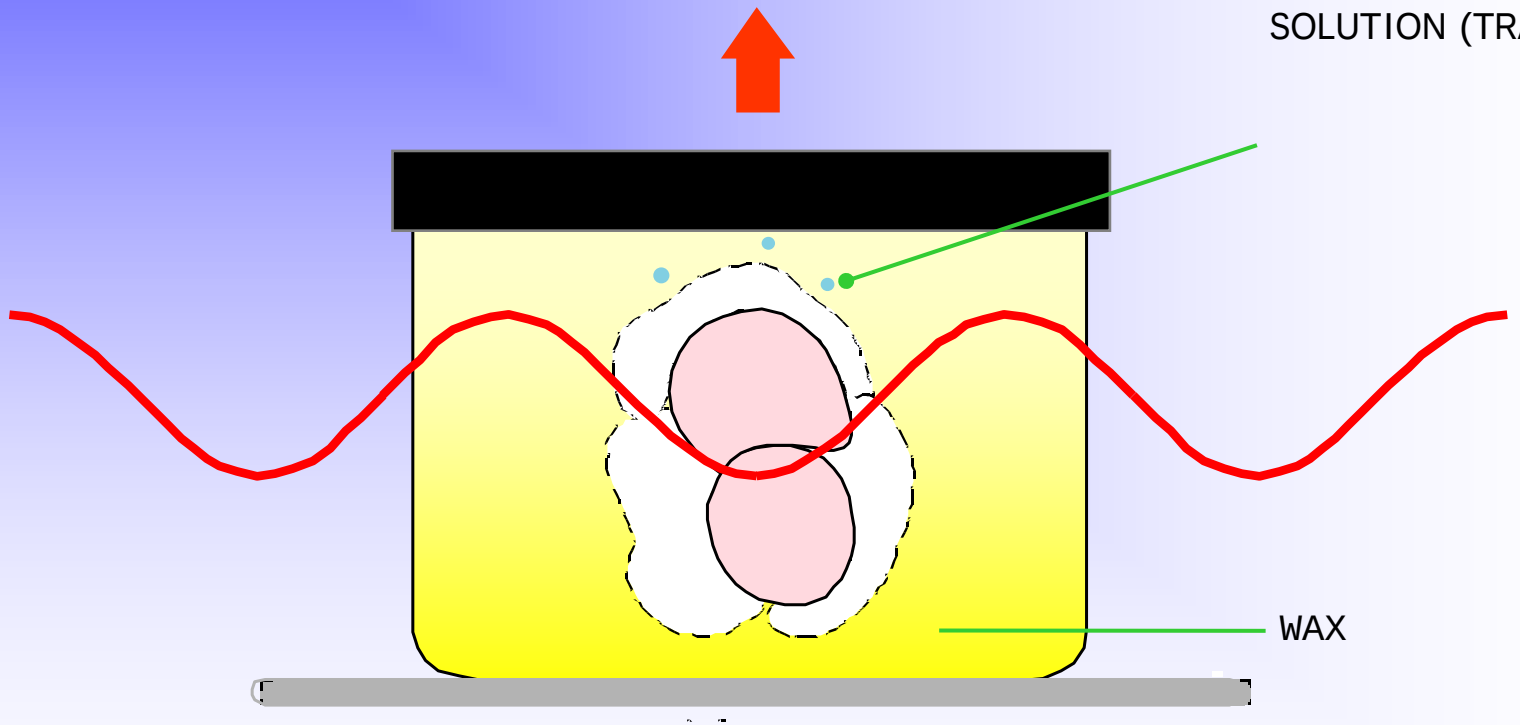
- Simultaneous dehydration/clearing with JFC or Prowave
- Temperature : at 70°C to reduce reaction time

Histoprocessing step 2



- Drying under vacuum
- Boiling point reduced to avoid tissue damage

Histoprocessing step 3



- Wax impregnation under high vacuum
- Eliminate last traces of JFC solution
- Wax is left uncontaminated - can be reused

Results

- H&E slides, Special Stains and IHC slides are at least as good as those from conventional processing.
- 3 - 5 times faster than conventional processing.
- Multiple runs within a normal working day.
- Suitable for overnight runs as well.
- Less expensive than conventional processing.
- No Xylene used, and can be formalin free as well.
- Don’t change your wax for 1 - 3 months!
- No requirement for proprietary reagents.

In future, the best cooks will come from AP - perfect results from the microwave every time!