RWD

E.S.V.I
Vetolabo

ANESTHESIA MACHINE

RWD Life Science

www.rwdls.com

CONTENTS

01

Inhalation Anesthesia

Inhalation Anesthesia-Principle

- Anesthesia
  - Local Anesthesia
  - General Anesthesia
    - Injection Anesthesia
    - **Inhalation anesthesia**

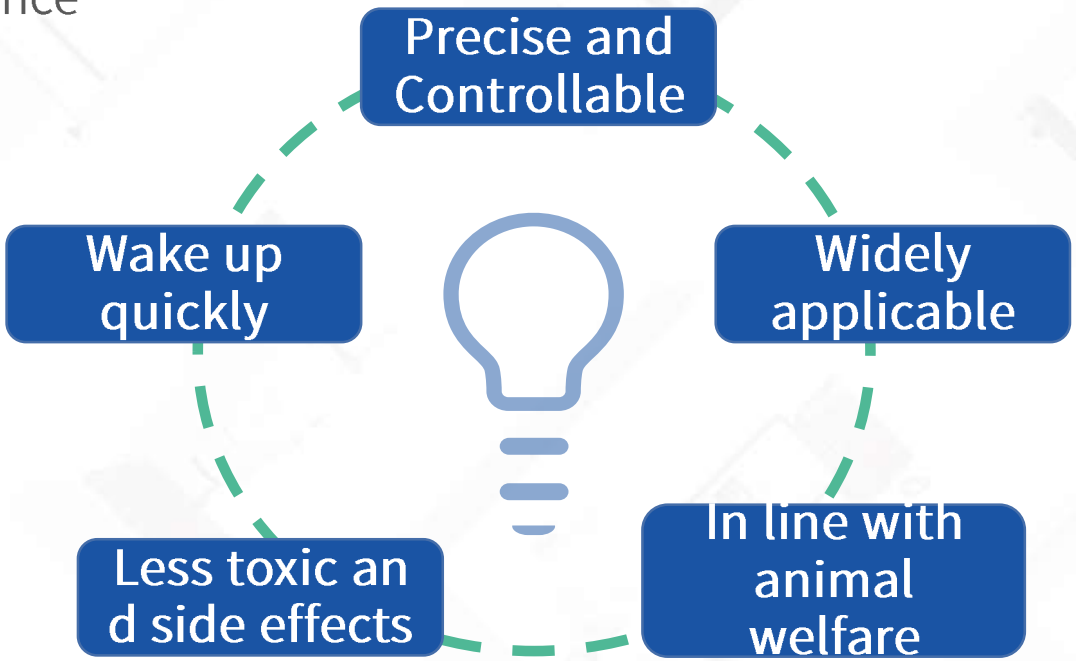
Definition The drug is administered through animal respiration. The gas anesthetic is absorbed from the alveoli into the blood circulation, and then transported to the central nervous system through the blood, so as to achieve the purpose of animal anesthesia.

Principle It has inhibitory effect and does not cause the increase of intracranial pressure; The blood pressure is decreased by reducing the resistance of peripheral blood vessels, but the coronary blood flow is not changed; Its respiratory inhibition is related to the dose, and its vapor can be inhaled through the vaporizer of the anesthesia machine for general anesthesia induction and maintenance.

Inhalation Anesthesia-Advantage

Inhalation : The vaporizer accurately adjusts the anesthetic concentration, the output is stable
Injection : Anesthetic preparation cannot be completely accurate due to drug failure or differences in animal drug resistance

Inhalation： Induction and recovery were rapid
Injection： If the dose is not accurate, it will prol-ong the recovery time af ter operation



Inhalation： It is suitable for mo st experiments, especially those that need to monitor physiologic al parameters for a long time
Injection： The long-term experi -mental signs may be unstable, a nd the injection level is required

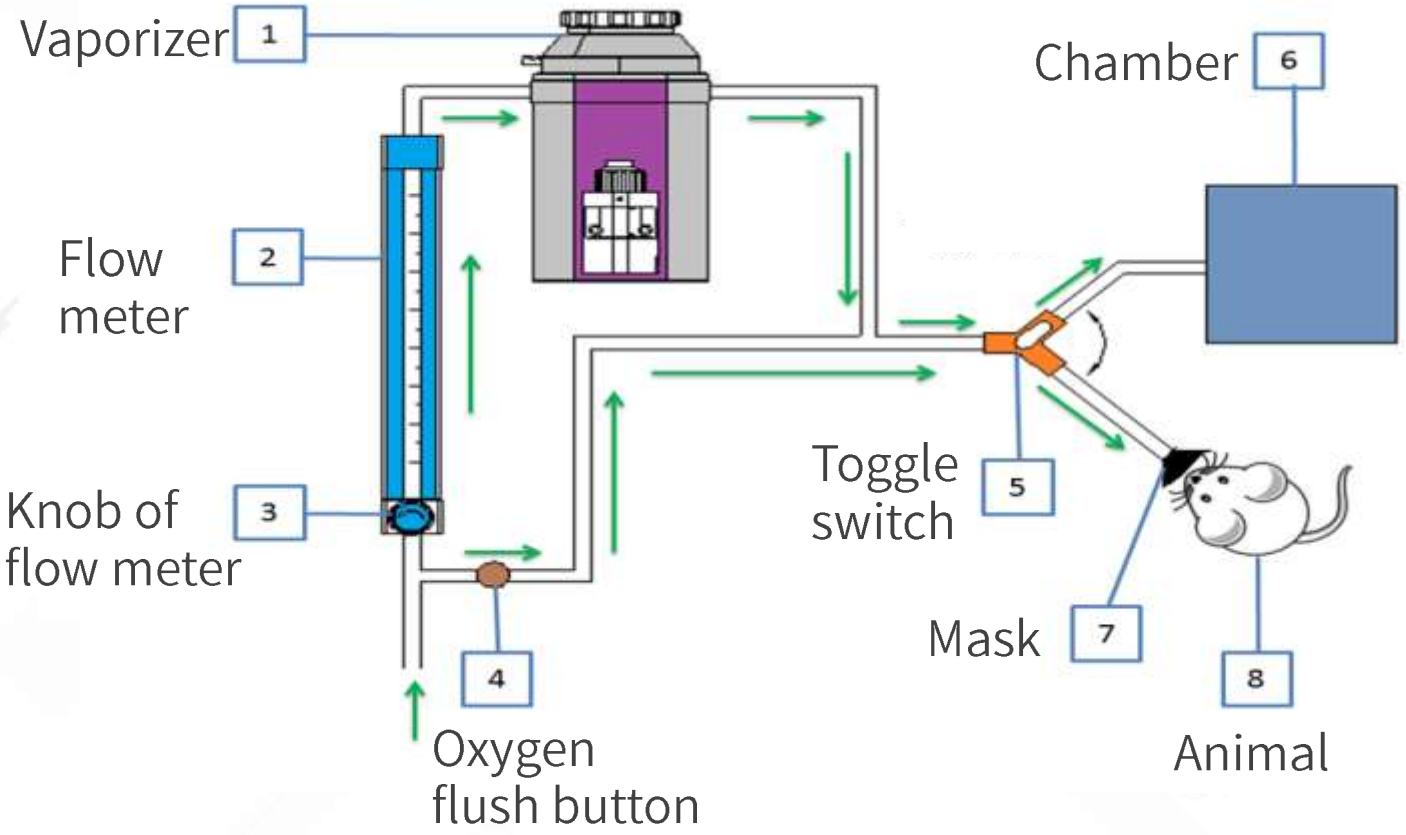
Inhalation： It does not participate in metabolism and has little hepatorenal toxicity
Injection： High metabolic toxicity, causing liver and kidney damage

Inhalation： In line with animal welfare
Injection： Risk of rejection

02

Small Animal Anesthesia Machine

Small Animal Anesthesia Machine



Principle: The air source enters the vaporizer after the flow rate (L / min) is adjusted by the flow meter, and the anesthetic gas is transmitted to the chamber or mask end. The chamber is used for rapid induction anesthesia in the initial stage, and the mask is used for long-term maintenance anesthesia in the later stage. Anesthetic gas enters the blood through the lungs of animals, and then enters the circulatory system to make the animals enter the state of anesthesia.

Small Animal Anesthesia Machine

Gas source | Main engine | Induction and maintenance anesthesia | Gas recovery system

1 Air Pump

2 Main engine : Flow meter & Vaporizer

3 Chamber

4 Mask

5 Canister

6 Gas Evacuation Apparatus

Small Animal Anesthesia Machine

Gas source | Main engine | Induction and maintenance anesthesia | Gas recovery system

1 Air Pump

Small Animal Anesthesia Machine

Provide air

Air Pump

- Small size, easy to move;
- Noise below 40dB;
- The conveying air flow is stable and the air flow is sufficient;

Provide oxygen

Oxygenerator

- Based on the principle of pressure swing adsorption of molecular sieve, the source is air, and the triple filtration of filter paper, filter and humidification bottle is adopted;
- The oxygen flow rate of 5L / min meets most of the experimental requirements;
- Low oxygen concentration and other low pressure alarm functions;
- The fuselage is light and easy to move;

Oxygen bottle

- Used with pressure reducing valve;
- It is used when the large animals anesthesia machine is combined with ventilator.

Small Animal Anesthesia Machine

Gas source | **Main engine** | Induction and maintenance anesthesia | Gas recovery system

2 Main engine: Flow meter & Vaporizer

Small Animal Anesthesia Machine

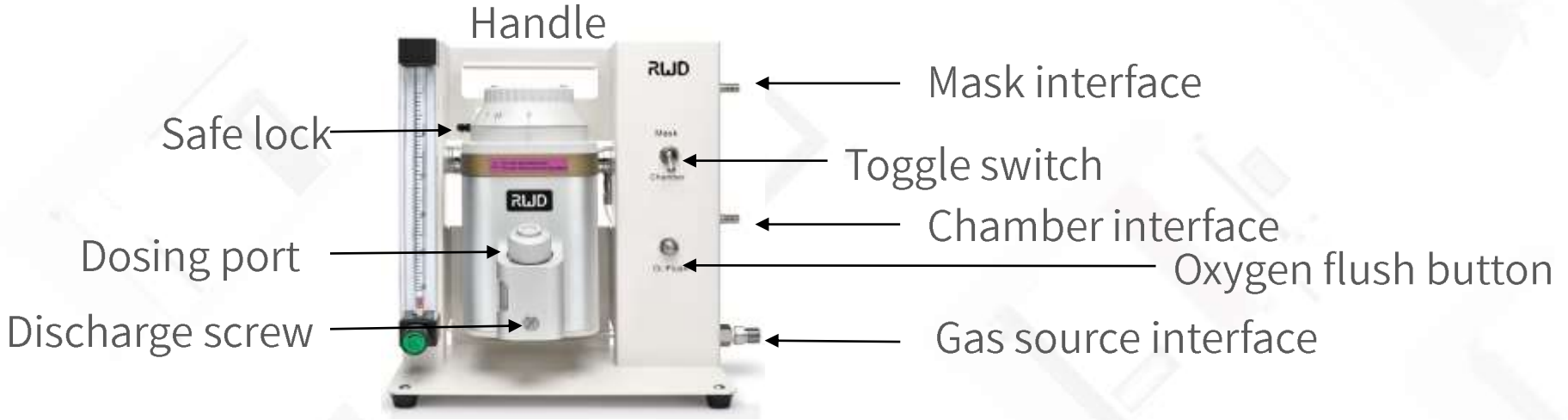
Flow meter

- **Purpose**: Adjust the flow of gas source, unit: L / min;
- **Type**: Oxygen flowmeter ;
- **Specification**: 0-1L, 0-4L ;
- **Reading**: The position of the white mark point of the red float corresponds to the current flow ;
- **Advantages**: Clear and stable display ;

Expansion flowmeter

- **Purpose**: Adjust the flow of the two air sources respectively to make them mix into the vaporizer according to a certain proportion ;
- **Type**: Oxygen / Nitrous Oxide (N_2O) / Carbon Dioxide flowmeter ;
- Specification: 0-4L

Small Animal Anesthesia Machine



Vaporizer

- **Scope:** Small animals within 7kg, such as mice, rats, guinea pigs, cats and rabbits
- **Purpose:** Evaporate liquid anesthetic into anesthetic gas and adjust its output concentration (%);
- **Type**: It is divided into Isoflurane vaporizer and Sevoflurane vaporizer according to anesthetics

  According to the dosing method, it is divided into Pour Fill-P, Easy Fill-E and Key Fill-K;
  Tightness Pour Fill < < Easy Fill < Key Fill



- **Specification:** Isoflurane adjustable concentration 0-5%, Sevoflurane adjustable concentration 0-8%;

Small Animal Anesthesia Machine

Vaporizer

- Advantage

Safe

- The Vaporizer has O-ring to fill the pores and strong gas-liquid seal;
- Safety lock design, the concentration can be adjusted by pressing the button to prevent accidental opening and accidental collision during the experiment;
- The leakage of easy fill dosing method shall not be greater than 0.75g;
- The key fill dosing method ensures that the residue in the bottle is less than 1ml after dosing;
- The dosing adapters of easy fill and key fill have strong sealing performance.

Stable

- The evaporation cloth can absorb 20-30mL anesthetic. If the anesthetic is exhausted during the operation, 1-1.5% of the anesthetic can be released for 10 minutes;
- Laser radium carving technology, accurate identification of concentration scale; Full inspection and delivery, and each one is attached with a quality inspection report;
- The output is not affected by the changes of flow, temperature, flow rate and pressure;
- Good temperature and flow compensation performance, 10 °C low temperature still maintains accurate concentration output;
- The fluctuation range of output pressure is P ⩽ 2.5kpa, and the internal pressure can withstand 50kPa without leakage.

Small Animal Anesthesia Machine

Isoflurane

R510-22-10

- **Specification**: 100mL / bottle, 10 bottles / box;
- **Shelf life:** three years;
- **Consumption calculation:**

  According to the information provided by VMR, the calculation formula of anesthetic consumption is as follows
  C (mL/ h) = 3 x% x F
  Where % refers to the selected concentration of anesthetic, and F refers to the flow rate of gas, in L/min

  For example, if the concentration is 2% and the oxygen flow rate is 0.6 L / min, the consumption of anesthetic is 3x2x0 6 = 3.6 mL / h, and a bottle of 100 mL anesthetic can last for 100 / 3.6 ≈ 28 hours. (The actual consumption time is affected by adjustment parameters and individual differences of animals, so it is impossible to accurately calculate the value)

Small Animal Anesthesia Machine

Toggle switch

- **Purpose**: Control the gas path to the Chamber or Mask;
- **Advantages:** Fast and convenient switching, with a service life of more than 100000 times.

Oxygen flush button

- **Purpose:** Fill the gas source into the gas path for flushing the gas path or animal first aid;
- **Advantages:** The airflow speed can reach 10L / min, which can eliminate the residual anesthetic gas in the pipeline or anesthesia Chamber as soon as possible, and can also give oxygen quickly to wake up the animals.

Small Animal Anesthesia Machine

Model introduction

R500

Upgrade Mobile
Easy to move and save space

R530

Handle upgrade
Wall mountable

R550

Upgrade five channels
Improve experimental efficiency

R540

Upgrade Mobile
Easy to move and save space

R520

Small Animal Anesthesia Machine

Gas source | Main engine | **Induction** and maintenance anesthesia | Gas recovery system

Small Animal Anesthesia Machine

Chamber

V101

- **Purpose**：The Chamber is a closed box, which is used to make the animals inhale a large amount of anesthetic gas during induction anesthesia and quickly enter the anesthesia state (it can be used as an euthanasia box when the gas source is CO2)；
- **Type**: According to the size, it is divided into mouse/rat /cat rabbit Chamber
- **Advantage**: ① Special acrylic material, good sealing, easy to observe the anesthetic state of animals, strong and durable, easy to clean;
  ② Flip design, the top cover is thickened, and plastic sealing strips are added at the contact part between the top cover and the box, which has good sealing performance;
- **Note**: When opening theChamber, first press the oxygen flush button to avoid the escape of anesthetic gas.

Small Animal Anesthesia Machine

Gas source | Main engine | Induction and **maintenance anesthesia** | Gas recovery system

4 Mask

Small Animal Anesthesia Machine

Mask

- **Purpose:** To make the experimental animals inhale anesthetic gas continuously during the maintenance anesthesia, which is convenient for the experimental personnel to carry out the operation;
- Type:

Concentric Tubing Masks

Cone Masks

Stereotaxic Frame Nosecone Masks

- **Advantage:** ① It has a wide range of applications and can meet the needs of multi-mode animals and multi scene surgery. The Concentric Tubing Mask and Cone Mask are MRI compatible;
  ② It is divided into active type and passive type. The active recovery type is matched with the Gas Evacuation Apparatus to make the waste gas "zero" leakage and safer;
  ③ The multi-channel mask can be selected to maintain the anesthesia of multiple animals at one time, which greatly improves the experimental efficiency.

Small Animal Anesthesia Machine

Gas source | Main engine | Induction and maintenance anesthesia | Gas recovery system

5 Canister

Small Animal Anesthesia Machine

Canister

R510-31S-6

R510-31-6

- **Purpose:** The interior is filled with activated carbon, which can absorb the anesthetic waste gas of the Chamber or Mask; When only the Canister is connected, it is called passive recovery (waste gas flows into the Canister along the pipeline)
- **Type:** Small size(self weight 250g, can absorb 50g waste gas, about half a bottle of anesthetic)
  Large size (self weight 800g, can absorb 200g waste gas, about two bottles of anesthetic)
- **Advantage:** Compared with competitive products, the adsorption ratio is lower. The adsorption ratio is the weight of activated carbon / the weight of adsorbable waste gas. The lower the adsorption ratio, the higher the absorption efficiency
- **Note:** The Canister is disposable consumables. Please replace it in time when it is saturated.

Small Animal Anesthesia Machine

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Gas source | Main engine | Induction and maintenance anesthesia | Gas recovery system

6 Gas Evacuation Apparatus

Small Animal Anesthesia Machine

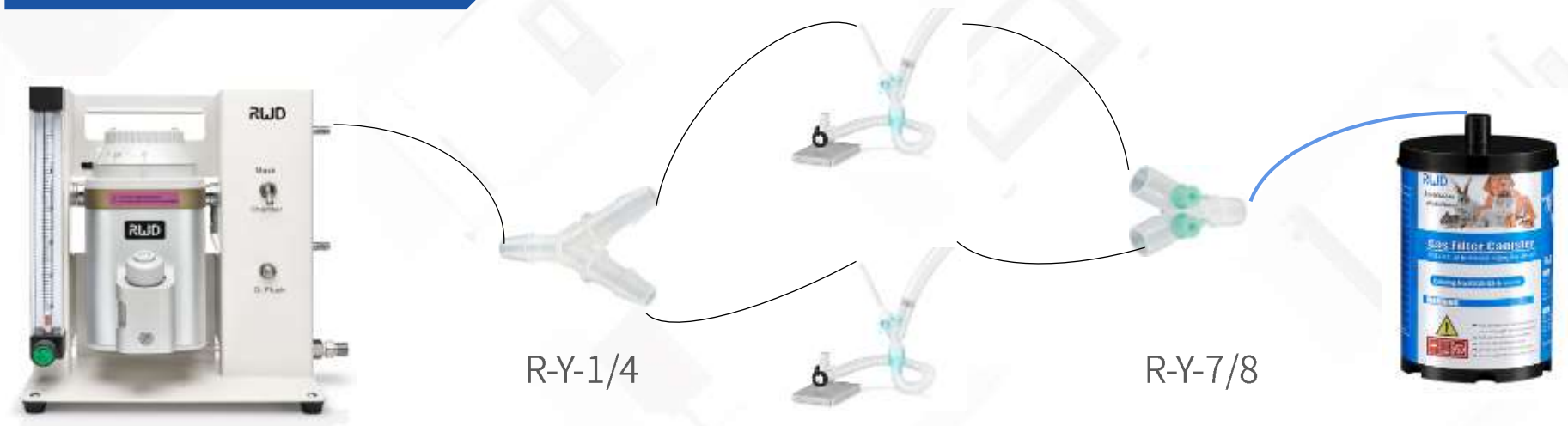
Gas Evacuation Apparatus

R546Pro

- **Purpose:**
  ① Weigh the weight of the filter tank and alarm for replacement when it is saturated;
  ② Actively suck the anesthetic waste gas at the Mask to prevent waste gas leakage;
- **Advantage:**
  ① The flow rate is continuously adjustable, with a range of 8 ~ 60L / min, and is displayed on the LED screen in real time;
  ② Overweight audible and visual alarm, level I (weight 990g), level II (1010g);
  ③ Automatic temperature compensation, weighing at 5 °C ~ 40 °C working temperature is more stable and accurate
  ④ Noise reduction on four sides, ultra silent motor is adopted, and the noise is less than 50dB

Small Animal Anesthesia Machine

Upgrade dual channel

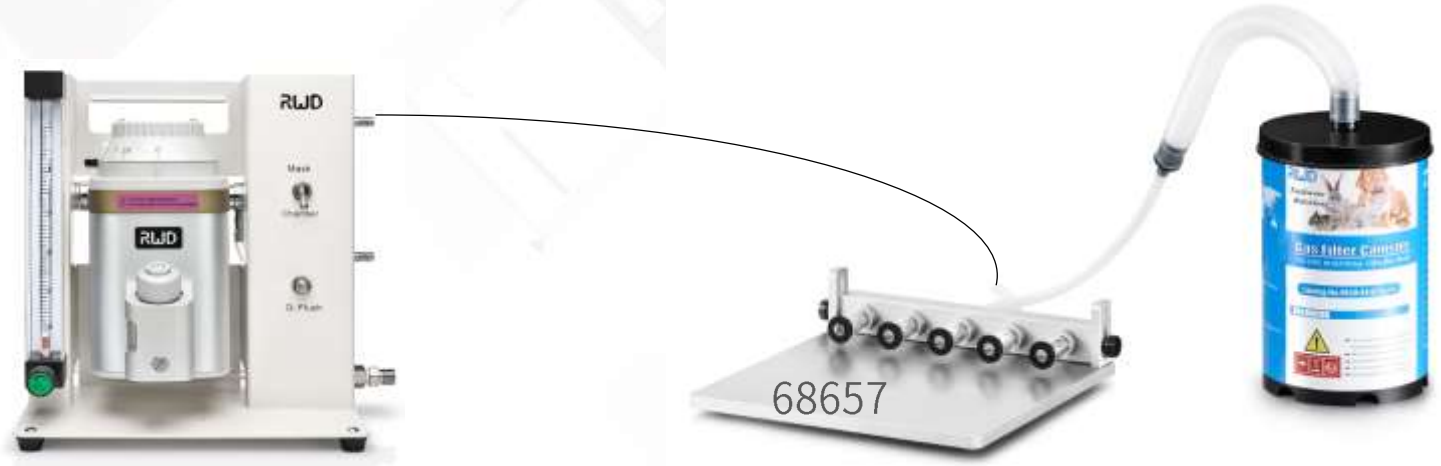


If the pipeline is modified directly, the air flow will be evenly distributed and cannot be adjusted

Double channel flowmeter is added, and the air flow of each channel can be adjusted

Small Animal Anesthesia Machine

Upgrade five channels

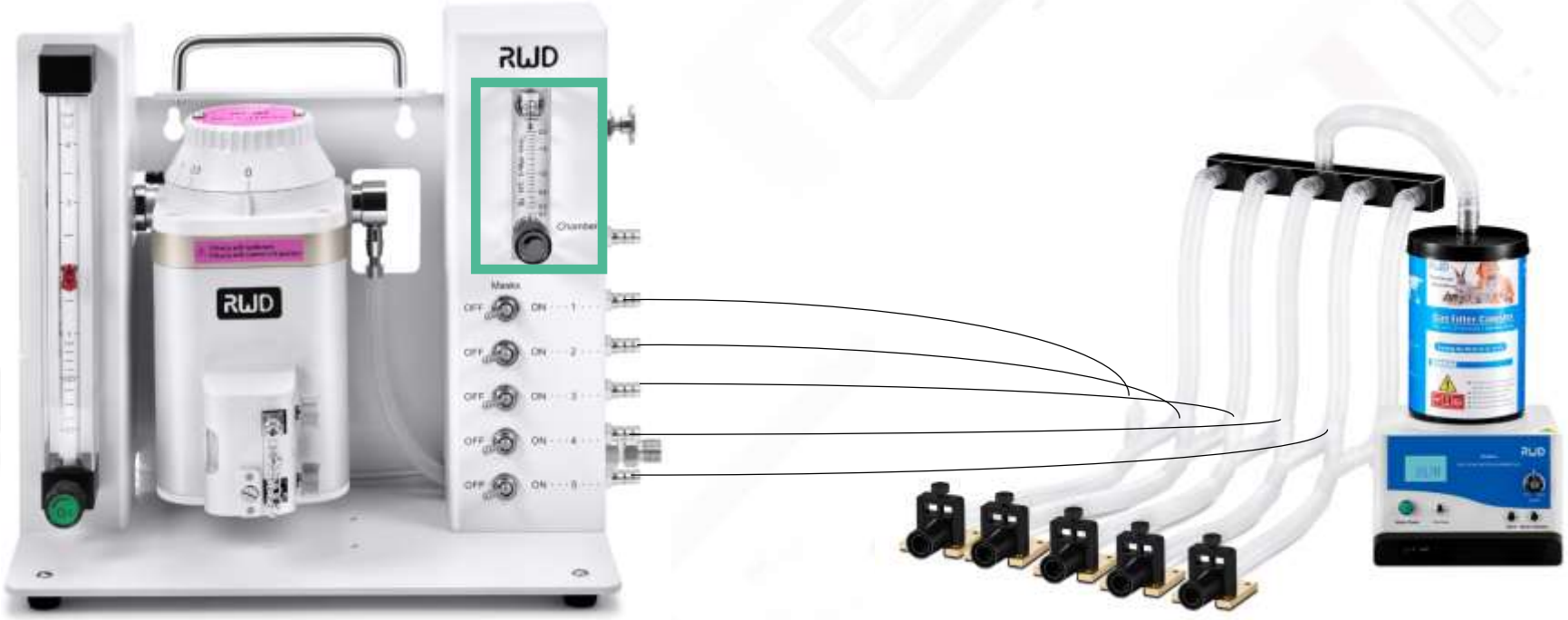


Using a five channel Cone Mask, the air flow will be evenly distributed and cannot be adjusted

Five channel flowmeter is added, and the air flow of each channel can be adjusted

Small Animal Anesthesia Machine

Upgrade five channels



- Using R550, five mask channels can control by the switch, and the flow can not be adjusted;
- The flow of the Chamber can be adjusted separately, which is suitable for the scene where some animals conduct induction anesthesia in the Chamber and some animals maintain anesthesia at the Mask.

Small Animal Anesthesia Machine

Combination Solutions of Ventilator to Anesthesia System

It can meet the operation of animals that cannot breathe autonomously due to respiratory dysfunction caused by some diseases (such as cardiovascular and cerebrovascular diseases, hypertension and cerebral infarction). It is suitable for animals within 1kg, such as mice and rats.

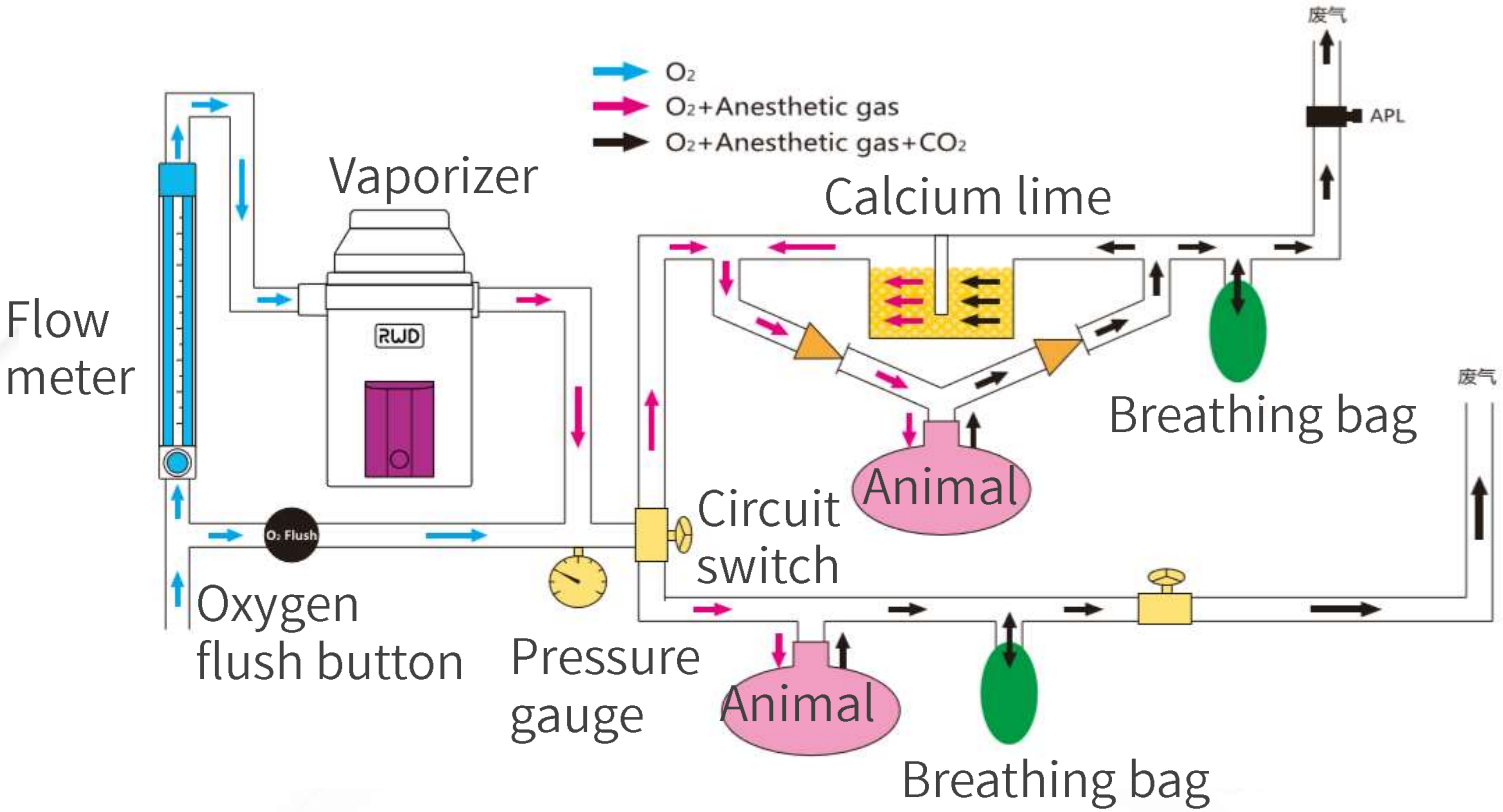
Stereotaxic Anesthesia Solutions

It is applied to the production of various models of nervous system diseases (such as PD, AD ,craniocerebral injury, spinal cord injury, etc.), brain drug injection, cannula implantation, physiological experiments (signal recording, wireless telemetry, etc.), microdialysis and other experiments.

03

Large Animal Anesthesia Machine

Large Animal Anesthesia Machine



Principle: the air source enters the Vaporizer after the flow rate (L / min) is adjusted by the flow meter, and the internal anesthetic gas is transmitted to the rebreathing circuit(> 7kg) or non-rebreathing circuit (< 7kg). Injection anesthesia is induced in the early stage, and the mask is used to maintain anesthesia for a long time in the later stage Compared with small animals, large animals need more tidal volume, more precious and fragile.

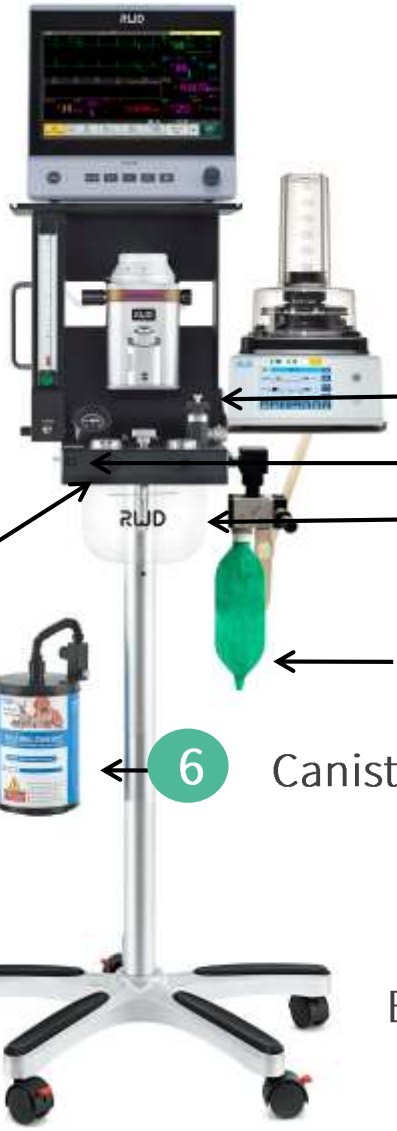
Large Animal Anesthesia Machine

1 Gas source

Pressure relief valve

O_2 tube

2 Anesthesia Machine



APL pressure relief valve

Circuit switch

CO_2 absorber

3 Circuit body assembly

Breathing bag

4 Breathing circuit

Rebreathing circuit

Non-rebreathing circuit

6 Canister

Mask

5 For animal

Endotracheal tube

Large Animal Anesthesia Machine

Circuit switch

- **Purpose:** Switch between Rebreathing circuit (RB) and Non-rebreathing circuit (NRB);
- **Advantages:** Simple and fast

Pressure relief valve blocking key

- **Purpose:** Press to block APL valve and stop pressure relief;
- **Advantages:** Quickly close the pressure relief, avoid repeated screwing during first aid, and save time

CO_2 absorber

- **Purpose:** Filling calcium lime to absorb CO_2 exhaled by animals;
- **Advantages:** large amount of filling and convenient disassembly.

Large Animal Anesthesia Machine

Rebreathing circuit

R-BC-DL

- **Purpose:** The circuit used for maintaining anesthesia in animals with weight > 7kg ;
- **Advantage:** ① The anesthetic is saved. The gas flow of normal large animals is 200mL/ kg, which is only 50mL / kg when using the Rebreathing circuit ;
  ② Keep the gas breathed by animals in a warm and humid state ;

Non-rebreathing circuit

R-NBC-F(JR)

- **Purpose:** The circuit used for maintaining anesthesia in animals with weight ＜ 7kg ;
- **Advantage：** It is suitable for animals with low tidal volume and has no dead space.

Large Animal Anesthesia Machine

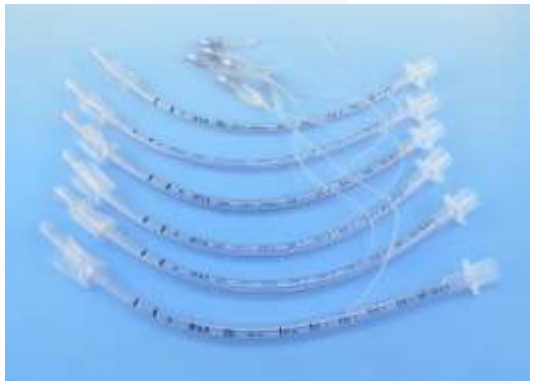
Mask

68643

- **Purpose:** To make the animals inhale anesthetic gas continuously during the maintenance anesthesia, and only place it at the mouth and nose for the convenience of the experimenter for operation;
- **Advantages:** applicable to a wide range of body weight;

Endotracheal tube

R600-ET



- **Purpose:** Insert into the trachea of animals to deliver anesthetic gas during anesthesia, and cooperate with ventilator;
- **Advantages:** Applicable to a wide range of body weights.

Large Animal Anesthesia Machine

Solution

A complete set of solutions for anesthesia , respiratory , monitoring of 100kg large animals such as pigs, monkeys, dogs and cats.

Mask

Laryngoscope

Oxygenerator

Endotracheal tube

Calcium lime

04

Product Advantages

Product Advantages

Safe

- **Inhalation anesthesia has advantages：**
  Inhalation anesthesia ensures the survival rate of animals, improves the success rate of experiment, makes the experimental data more reliable, conforms to animal welfare, and has no risk of rejection;

- **Safe lock design：** Avoid the concentration change caused by accidental contact in the experiment；

- **Efficient adsorption of waste gas by gas recovery system：**
  The adsorption of the canister is combined with the suction of the Gas Evacuation Apparatus to prevent the escape of waste gas and ensure the physical and mental health of the experimenter;
  Case： The customer of a biotechnology company originally used the competitive canister and adopted the passive recovery method, which has poor recovery effect and large leakage of anesthetic waste gas in the imaging room. After that, our Gas Evacuation Apparatus is used to actively absorb waste gas, and the effect is good.

Product Advantages

Stable

- **Inhalation anesthesia has advantages：**

  The inhalation anesthesia concentration is accurate and adjustable at any time, without awakening delay, so as to ensure the repeatability of experimental data；

- **The concentration scale of Vaporizer is calibrated by laser, and each Vaporizer is subject to quality inspection of the whole Vaporizer：**

  ① The quality of the Vaporizer is guaranteed, which helps the experiment to be carried out stably. At the same time, high quality brings high cost performance;
  ② The Vaporizer shall stand for three months without leakage;
  ③ The Vaporizer has CE certification, quality inspection report, etc;

- The **Vaporizer** has good performance of temperature compensation and pressure compensation：

  It can maintain stable concentration output under extreme environment of high pressure or low temperature .

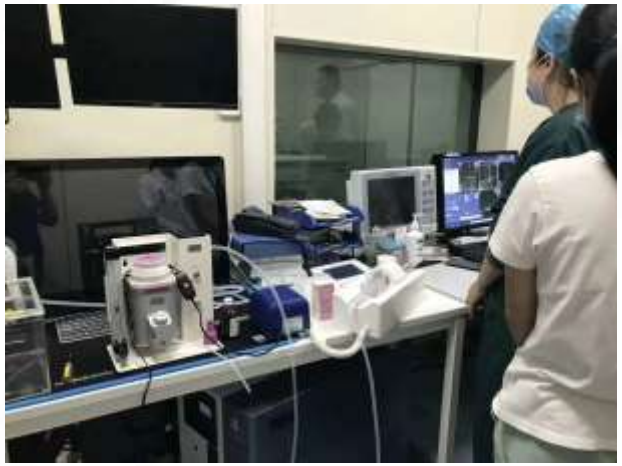
Product Advantages

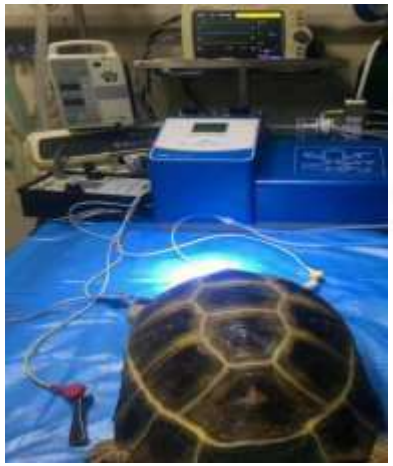
Multi scene

- **Various accessories：**

  It is suitable for various model animals with different body weights, and can carry out MRI and imaging experiments; Each part is managed separately. Compared with the integrated anesthesia machine, the replacement is convenient and the maintenance cost is low；

- **Rich solutions and complete downstream experimental equipment**

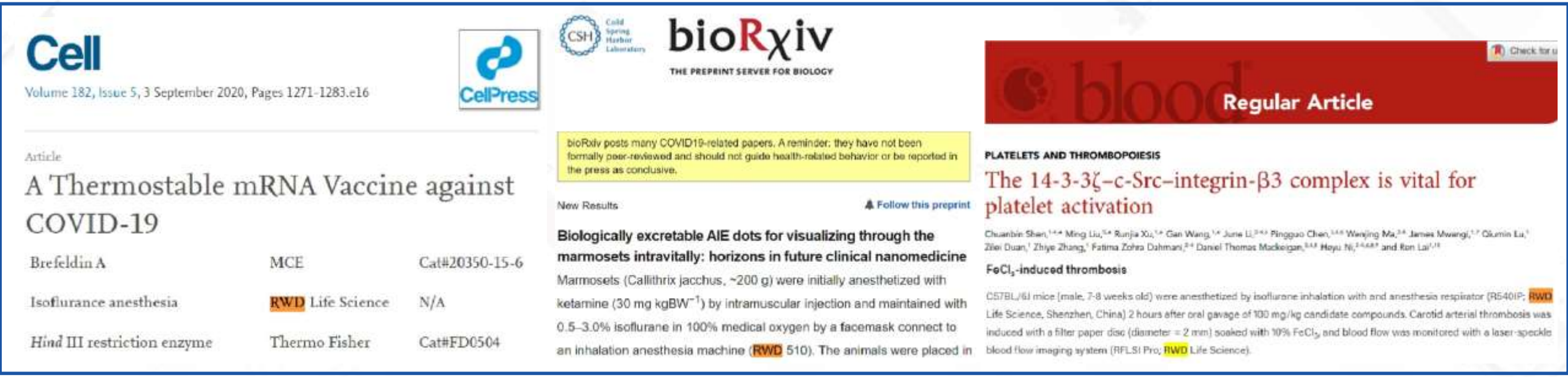




Product Advantages

Wide range of users

- After several years of deep cultivation in the field of scientific research, there are a large number of users and literature support： Universities and hospitals purchased: 1500 + domestic, 280 + foreign; 340 + literatures have been published, including 17 literatures with more than 10 points.



Cell

Volume 182, Issue 5, 3 September 2020, Pages 1271-1283.e16

CellPress

Article

A Thermostable mRNA Vaccine against COVID-19

Brefeldin A	MCE	Cat#20350-15-6
Isoflurance anesthesia	RWD Life Science	N/A
Hind III restriction enzyme	Thermo Fisher	Cat#FD0504

CSH Cold Spring Harbor Laboratory

bioRχiv

THE PREPRINT SERVER FOR BIOLOGY

bioRxiv posts many COVID19-related papers. A reminder: they have not been formally peer-reviewed and should not guide health-related behavior or be reported in the press as conclusive.

New Results

Follow this preprint

Biologically excretable AIE dots for visualizing through the marmosets intravitally: horizons in future clinical nanomedicine

Marmosets (Callithrix jacchus, ~200 g) were initially anesthetized with ketamine (30 mg kgBW^{-1}) by intramuscular injection and maintained with 0.5–3.0% isoflurane in 100% medical oxygen by a facemask connect to an inhalation anesthesia machine (RWD 510). The animals were placed in

blood

Regular Article

PLATELETS AND THROMBOPOIESIS

The 14-3-3ζ–c-Src–integrin-β3 complex is vital for platelet activation

$FeCl_3$-induced thrombosis

C57BL/6J mice (male, 7-8 weeks old) were anesthetized by isoflurane inhalation with and anesthesia respirator (R540IP; RWD Life Science, Shenzhen, China) 2 hours after oral gavage of 100 mg/kg candidate compounds. Carotid arterial thrombosis was induced with a filter paper disc (diameter = 2 mm) soaked with 10% $FeCl_3$ and blood flow was monitored with a laser-speckle blood flow imaging system (RFLSI Pro; RWD Life Science).

05

User Case

User Case

Highly recommended by Finnish customers

- Lillia, a teacher from the University of Finland, strongly recommended R540 anesthesia machine: stable and efficient anesthesia, simple operation and effective saving of operation time.
- RWD anesthesia products are recognized by the quality of the international market, serve 130 + countries and regions around the world, and contribute wisdom and strength to the improvement of quality of life.

User Case

Animal protection: on August 27, 2020, reward, together with Hoh Xil Wildlife Protection Association and China Environmental Monitoring magazine, donated animal medical equipment worth more than 1 million yuan to the giant panda National Park Administration, including animal anesthesia machine, animal ventilator and animal monitor, to support the protection of giant pandas in China .

User Case

- Peking University School of medicine purchased 7 sets of R500 small animal anesthesia combined ventilator solutions in 2019, which are mainly used for anesthesia of rabbits. The anesthetic effect has been recognized by customers.
- In 2019, R500 small animal anesthesia and respiration solution was honored to enter the laboratory of Nanjing Institute of molecular medicine, Peking University, making contributions to the development of scientific research institutions.

RWD

E.S.V.I Vetolabo

THANKS

THANKS FOR HAVING YOU ALL THE WAY

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