

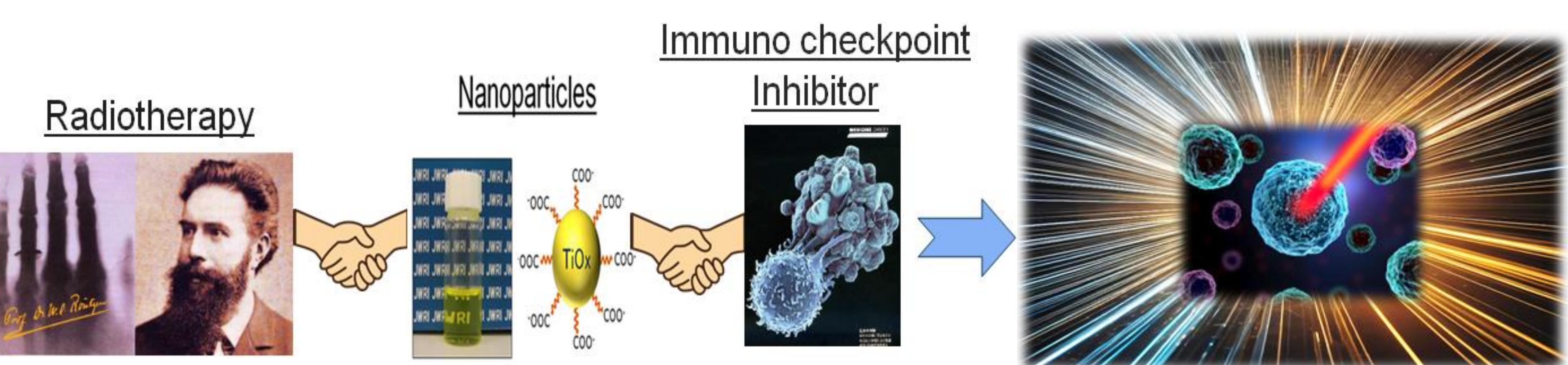
# 100年の放射線治療の概念を一新する放射線誘導性 がんワクチンの開発 ~Burst Therapyの実現~

医学研究科 放射線腫瘍学分野 佐々木 良平、赤坂 浩晃  
工学研究科 応用化学専攻 萩野 千秋

## アピールポイント

- 従来の放射線療法の効果は、局所に限定的だったが、Burst therapyでは、全身の病変に対して効果あり。
- Burst therapyでは根治線量ではなく小線量で効果があり、従来の副作用を懸念がない。
- 自己免疫を利用するので、抗がん剤の骨髄抑制等の副作用を心配する必要がない。
- 放射線抵抗性のがんにも治療効果が期待でき、適応が広がる。ワクチン効果により、再発を予防することが期待できる。
- 世界初の併用治療であり優位性がある。

## Combination of 3 modalities      Burst Therapy



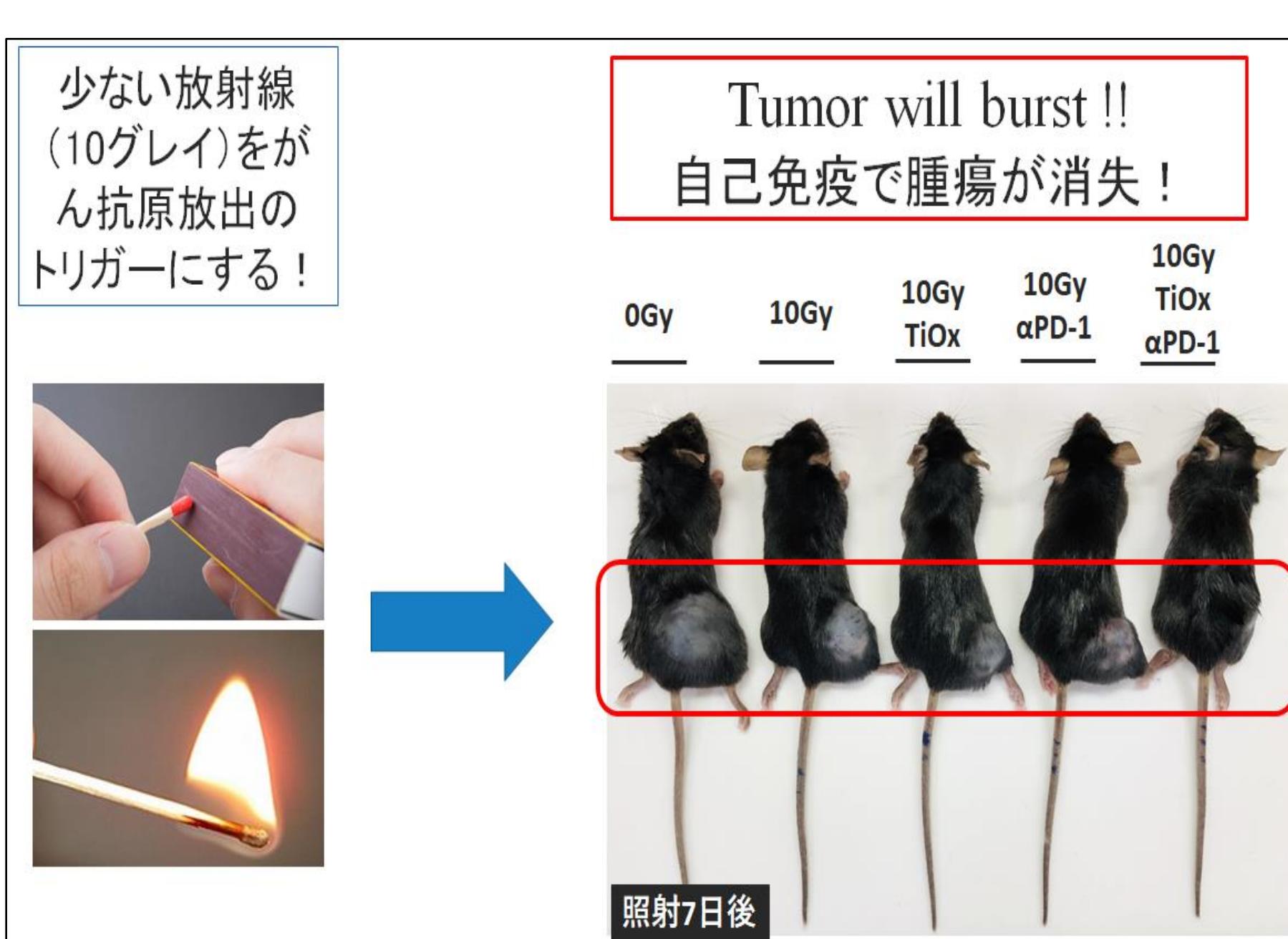
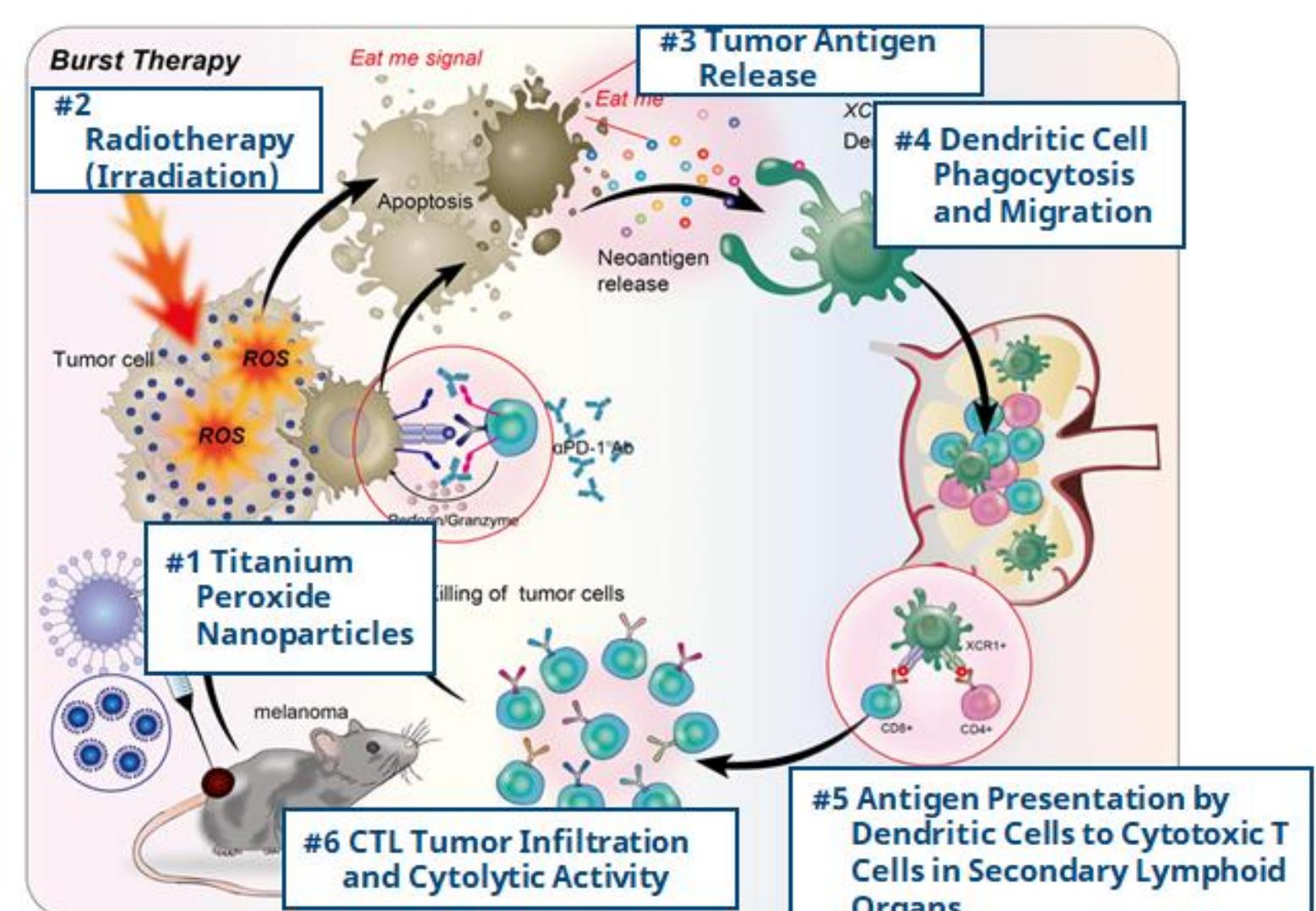
## Technical Significance

### Innovative Solution | Mechanism of "Burst Therapy"

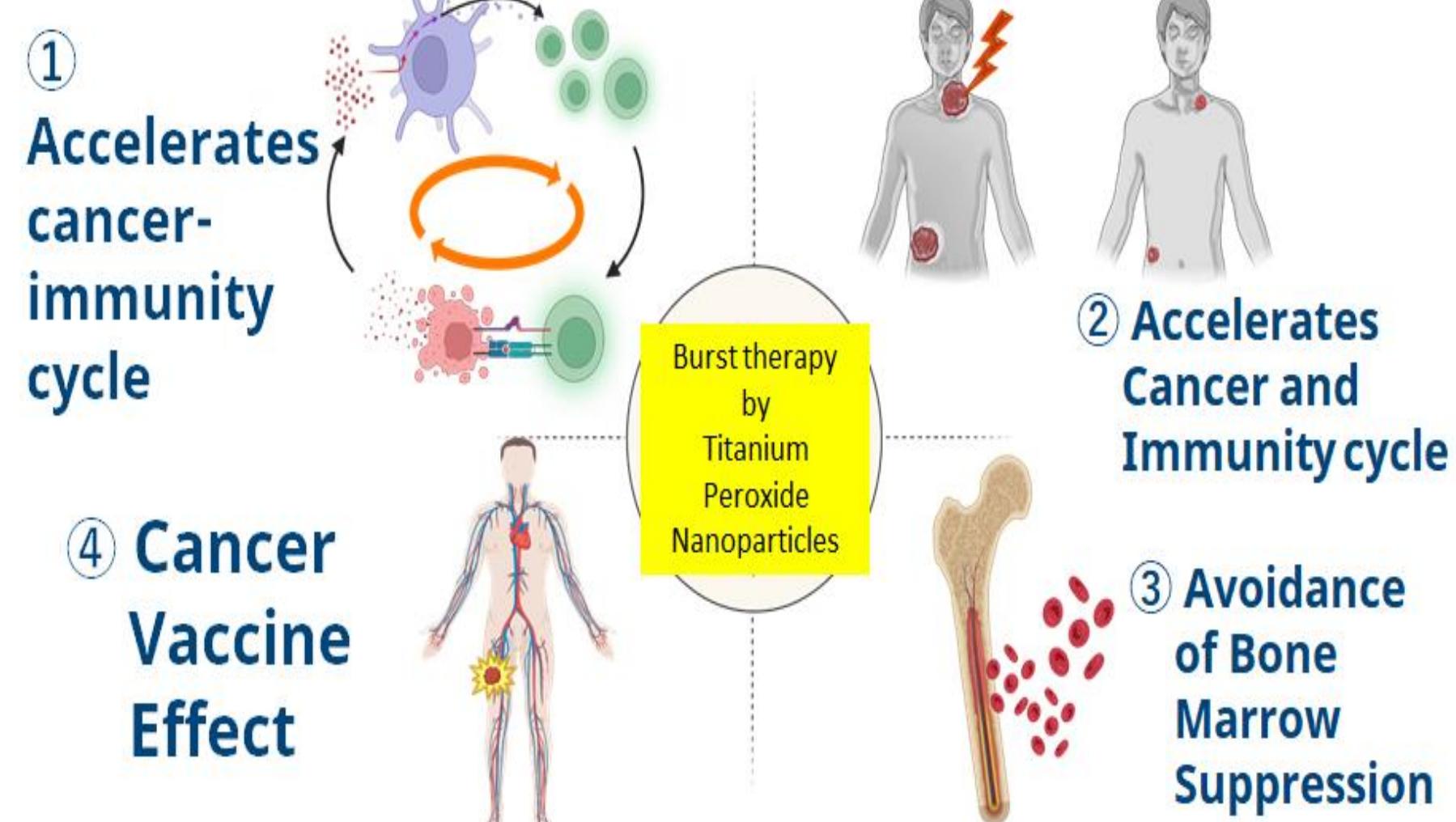
#### Burst therapy

- Titanium Peroxide Nanoparticles
- Radiotherapy (Irradiation)
- Immune Checkpoint Inhibitors (ICIs) ( $\alpha$ PD-1 Ab)

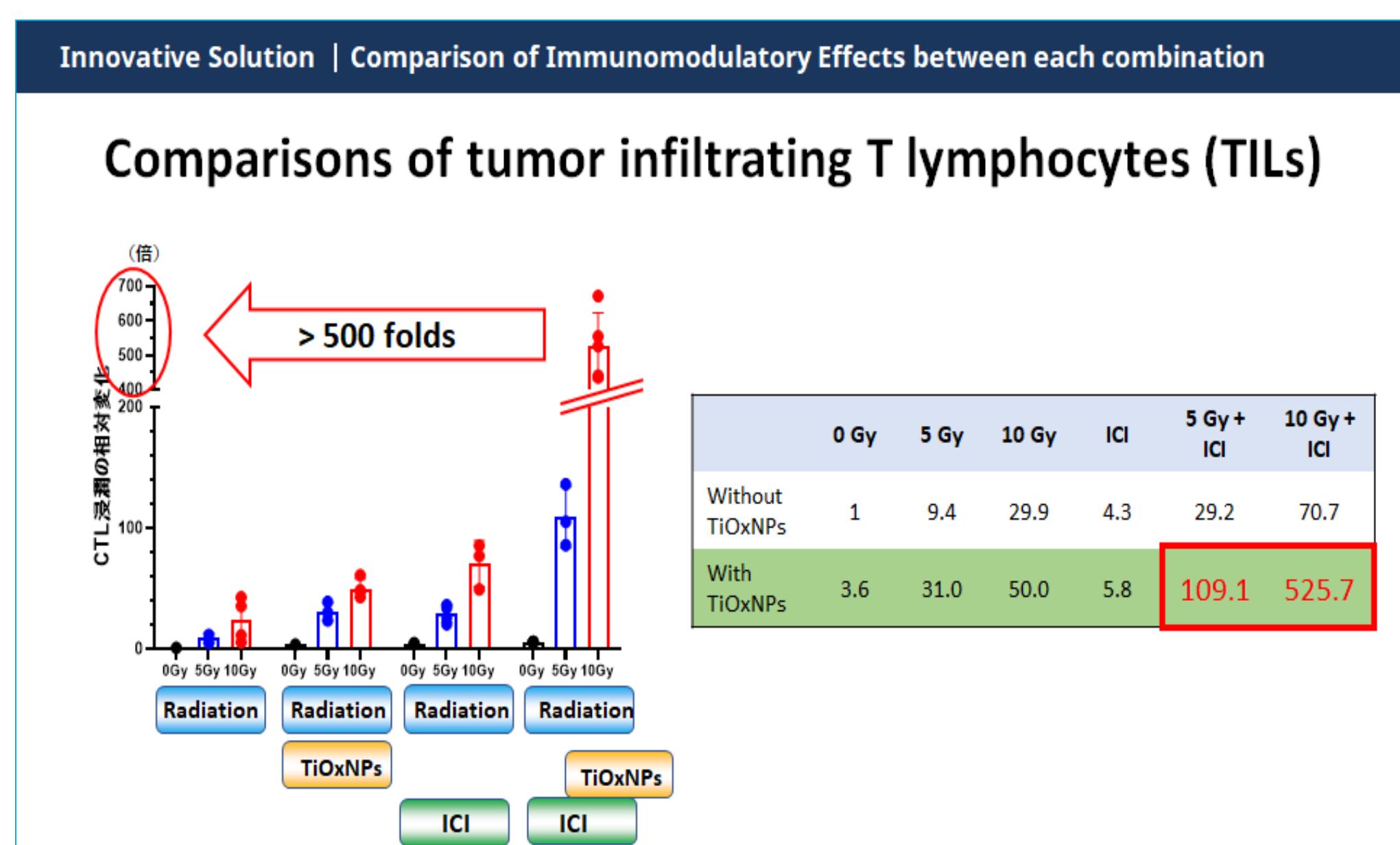
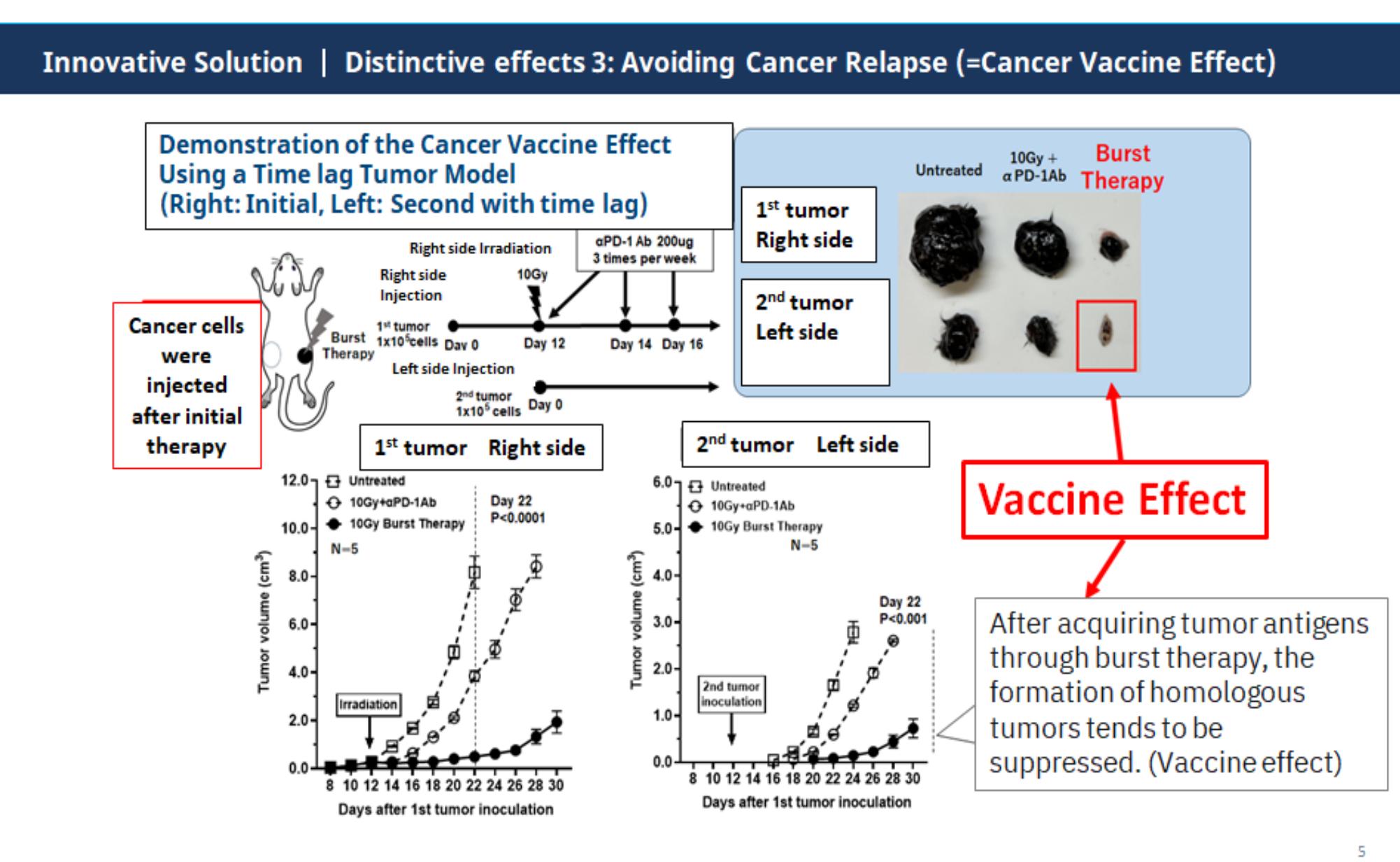
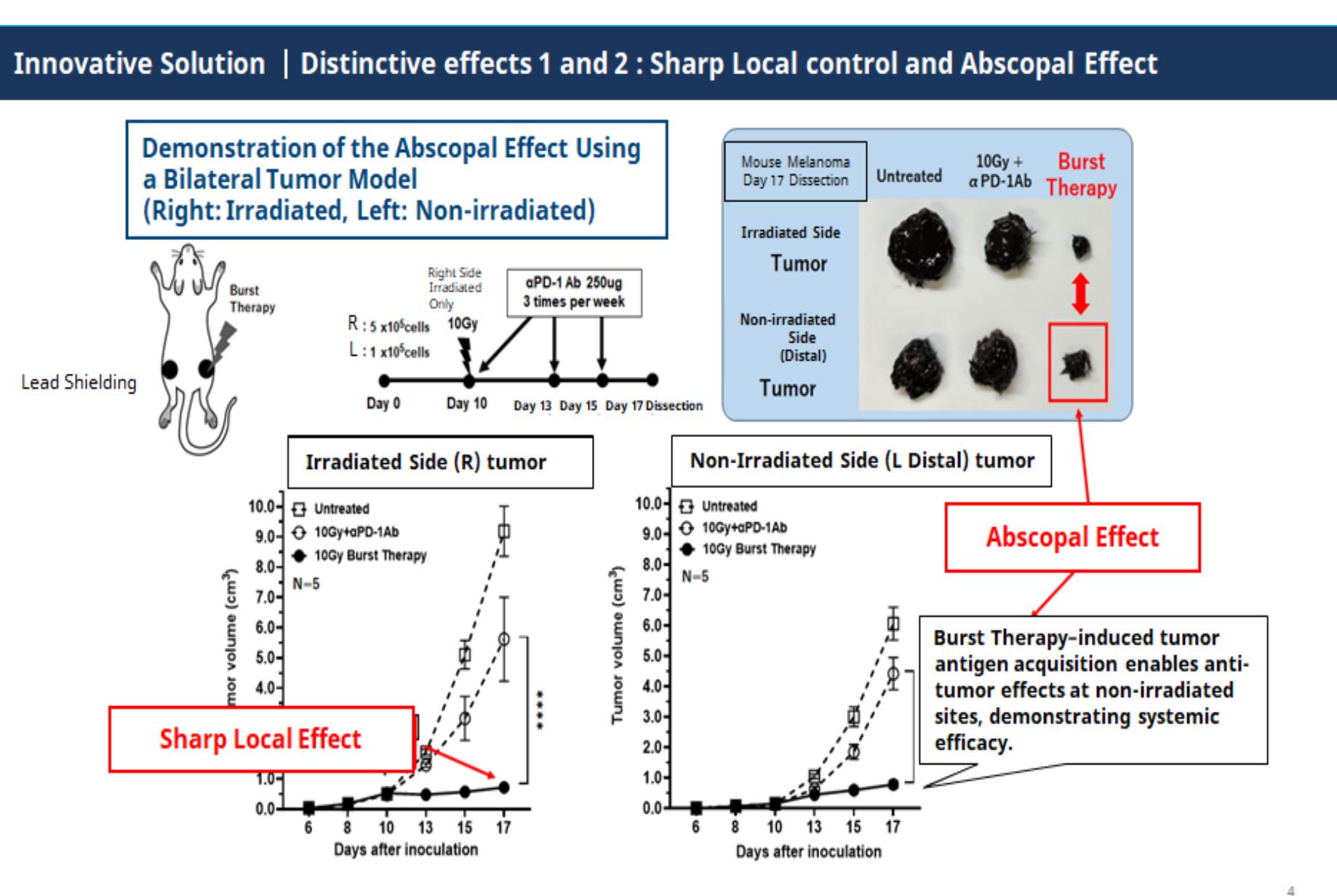
The combination of the above three accelerates the cancer-immunity cycle, achieving remarkable anti-tumor effects.



### Summary of Advantages of "Burst Therapy"



## Significant Findings

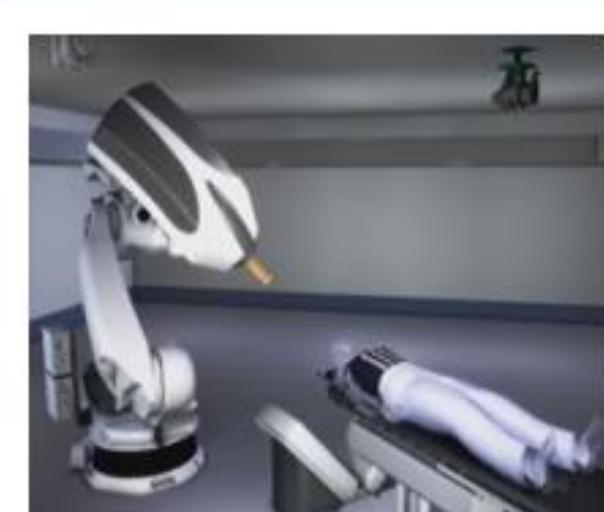


## Future Prospective

### 放射線の効果を上げる併用治療例

#### 放射線治療のみ

- Hyperfractionation  
SBRT Hypofraction  
Brachytherapy  
BNCT  
  
FLASH ?



大線量(70 グレイ)必要

#### 抗がん剤による増感

- 5-FU  
CDDP  
Taxane  
EGF receptor  
•



免疫・ナノ増感(Burst therapy)  
小線量(10 グレイ)で根治可能

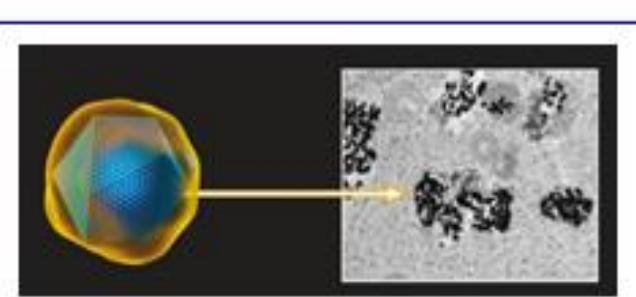
#### 免疫放射線

- PDL1  
PD1  
TIGIT



#### ナノ粒子による増感

- NBTRX3



その他、  
サナゾール  
KORTUC ?

本研究の新規性は、現在、過酸化チタンナノ粒子の製造と放射線増感効果に関しては基本特許(1)を押さえており、金ナノ粒子と比較し、増感効果に優位性を示した。さらに免疫チェックポイント阻害剤(ICI)を併用することで、爆発的な効果を有し、いわゆる内因性のがんワクチン療法になり得ることを示した発展的な特許(2)をも有している。

Filing Country	Title	Filing Date	Application Number	Patent Number	Status
WO (JP US)	PHARMACEUTICAL MEDICAMENT	2024/03/29	WO2024/204688	PCT/JP2024/012996	Under Consideration
WO (JP US CN)	RADIATION THERAPY AGENT	2011/02/17	WO/2011/102407	PCT/JP2011/053348	Granted (JP US CN)

# Radiation-Induced Cancer Vaccine: "Burst Therapy"

## Redefining Cancer Radiotherapy with Transforming Local Therapy into Systemic Therapy

Ryohei Sasaki, Hiroaki Akasaka, Graduate School of Medicine  
Chiaki Ogino, Bioengineering , Applied Chemistry, Kobe University

### Limitations of Current Cancer Treatments

**Radiation-resistant cancers:**  
Sarcomas and other refractory cancers show resistance to radiotherapy, limiting treatment efficacy.

**Metastasis management:**  
Radiotherapy as a local treatment has limited effect on metastatic lesions.

**Recurrence risk:**  
Insufficient surveillance mechanisms after treatment, leading to high recurrence rates.

**Normal tissue toxicity:**  
Conventional radiotherapy affects normal tissues, increasing risk of adverse effects.

### Challenges with Immune Checkpoint Inhibitors

**Limited response rates:**  
Single-agent efficacy remains at 20-30%, with limited effectiveness.

**Immune-related adverse events:**  
Risk of autoimmune reactions requiring treatment discontinuation in severe cases.

## Combination of 3 modalities

### Radiotherapy



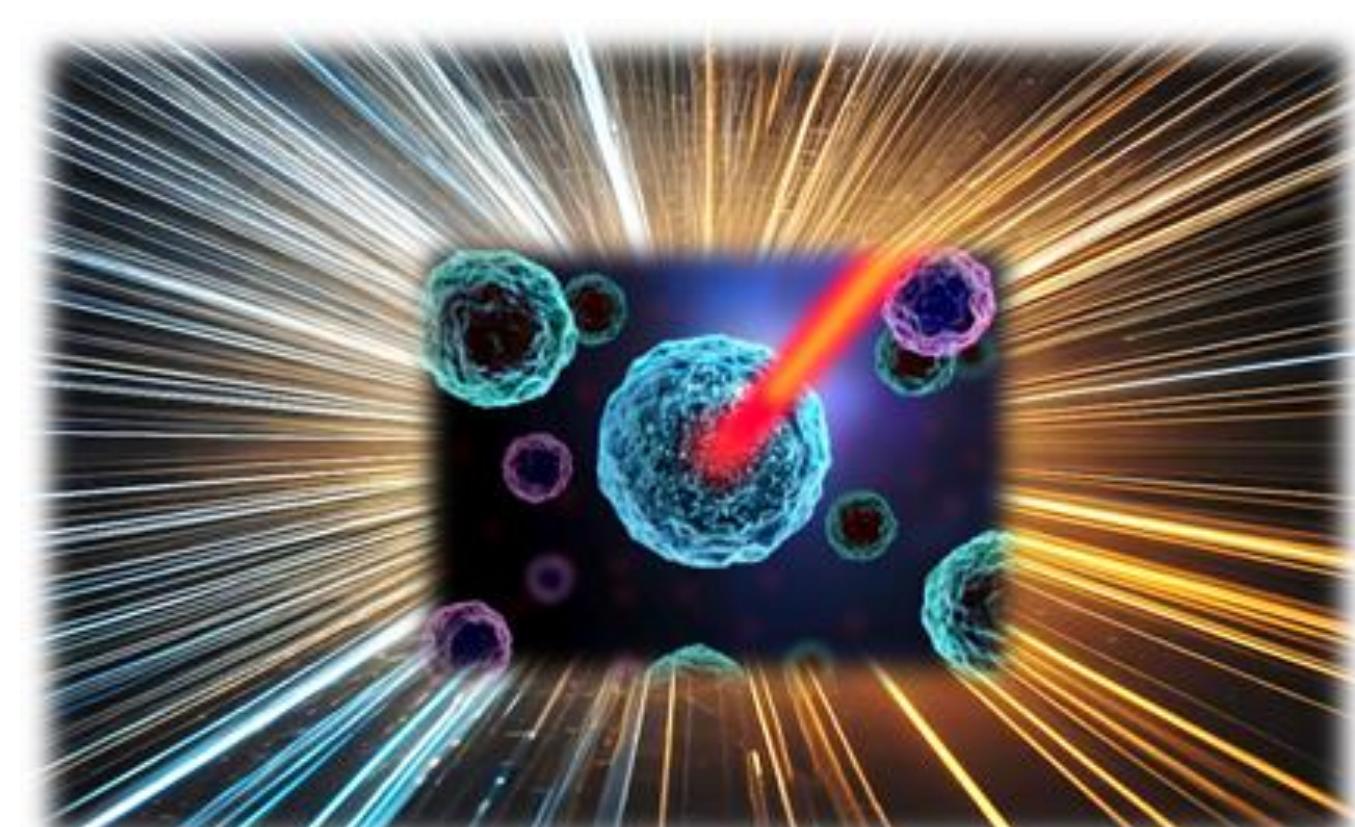
### Nanoparticles



### Inhibitor



## Burst Therapy



## Technical Significance

### Innovative Solution | Mechanism of "Burst Therapy"

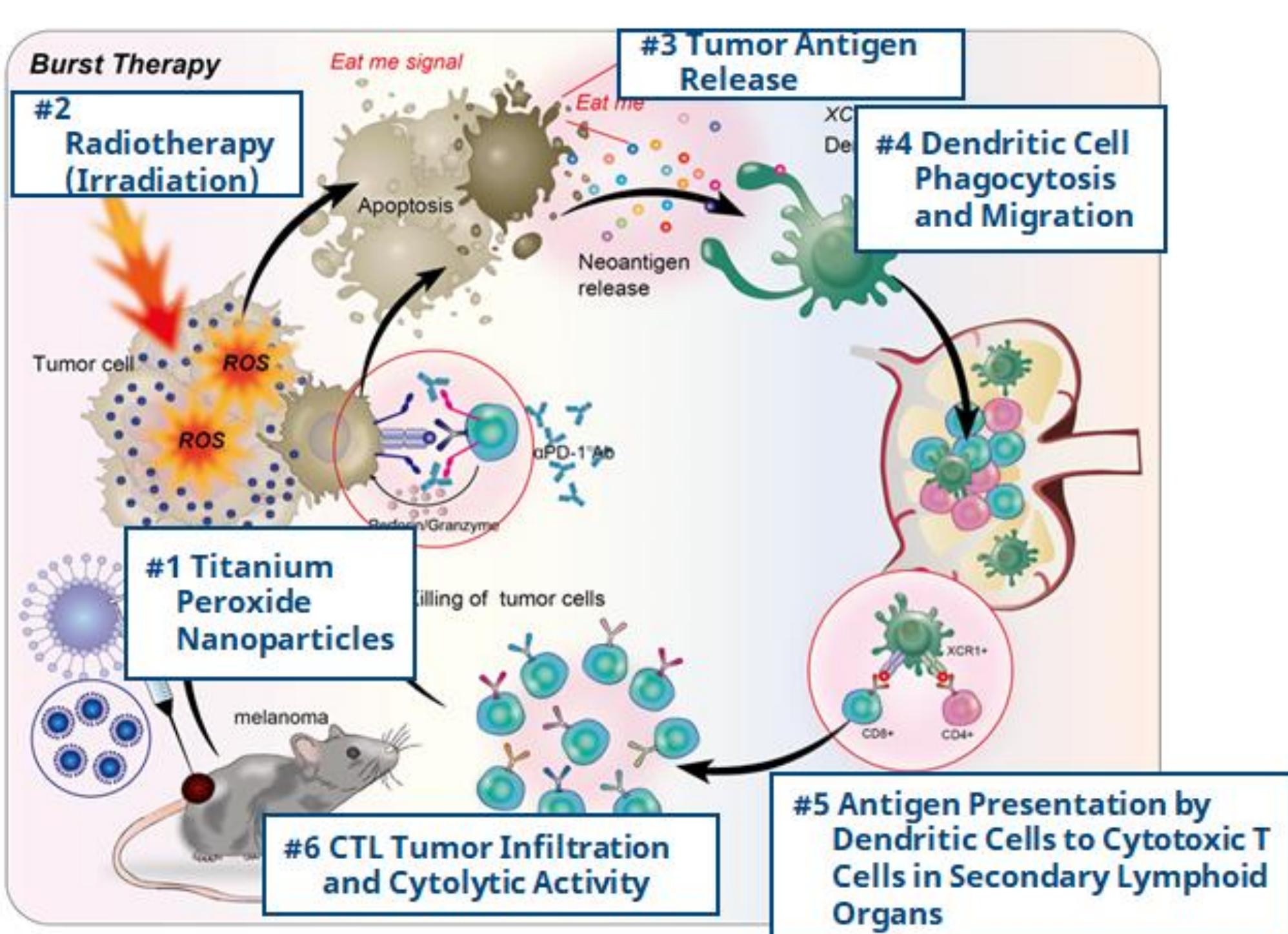
#### Burst therapy

1. Titanium Peroxide Nanoparticles

2. Radiotherapy (Irradiation)

3. Immune Checkpoint Inhibitors (ICIs) (αPD-1 Ab)

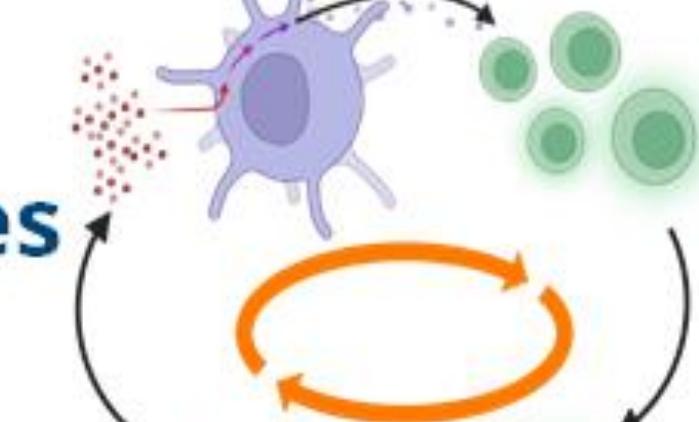
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### Summary of Advantages of "Burst Therapy"

①

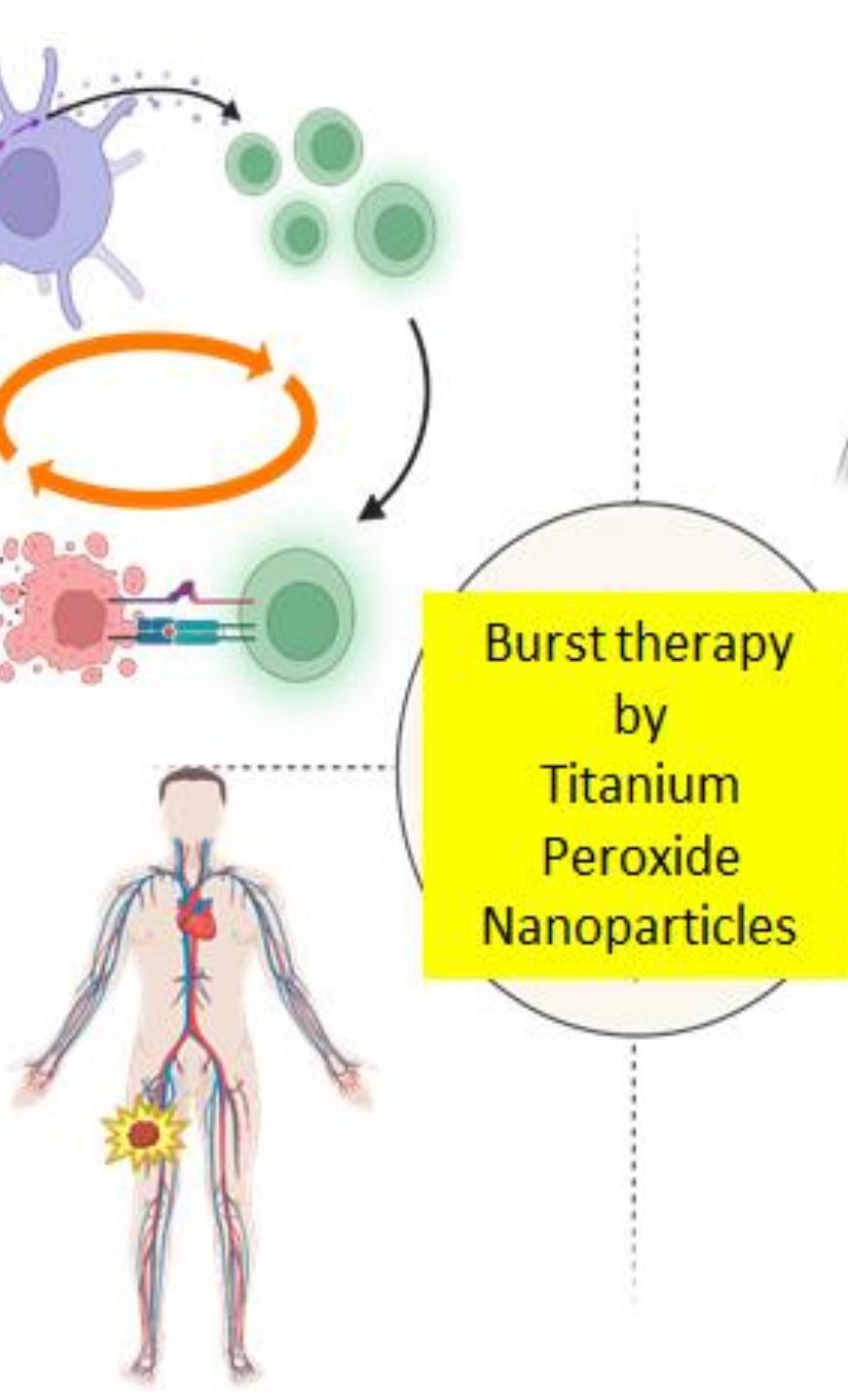
Accelerates cancer-immunity cycle



②

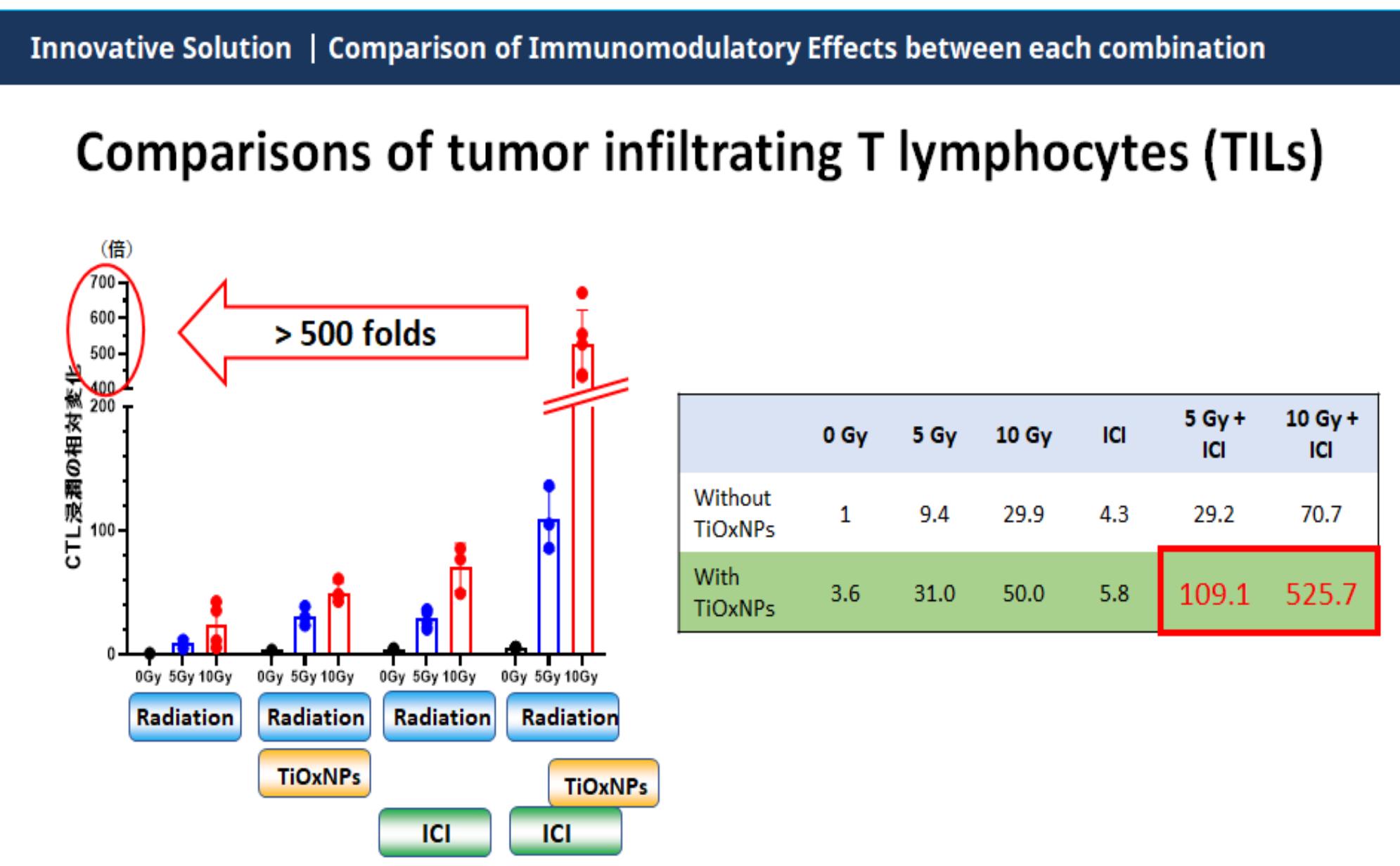
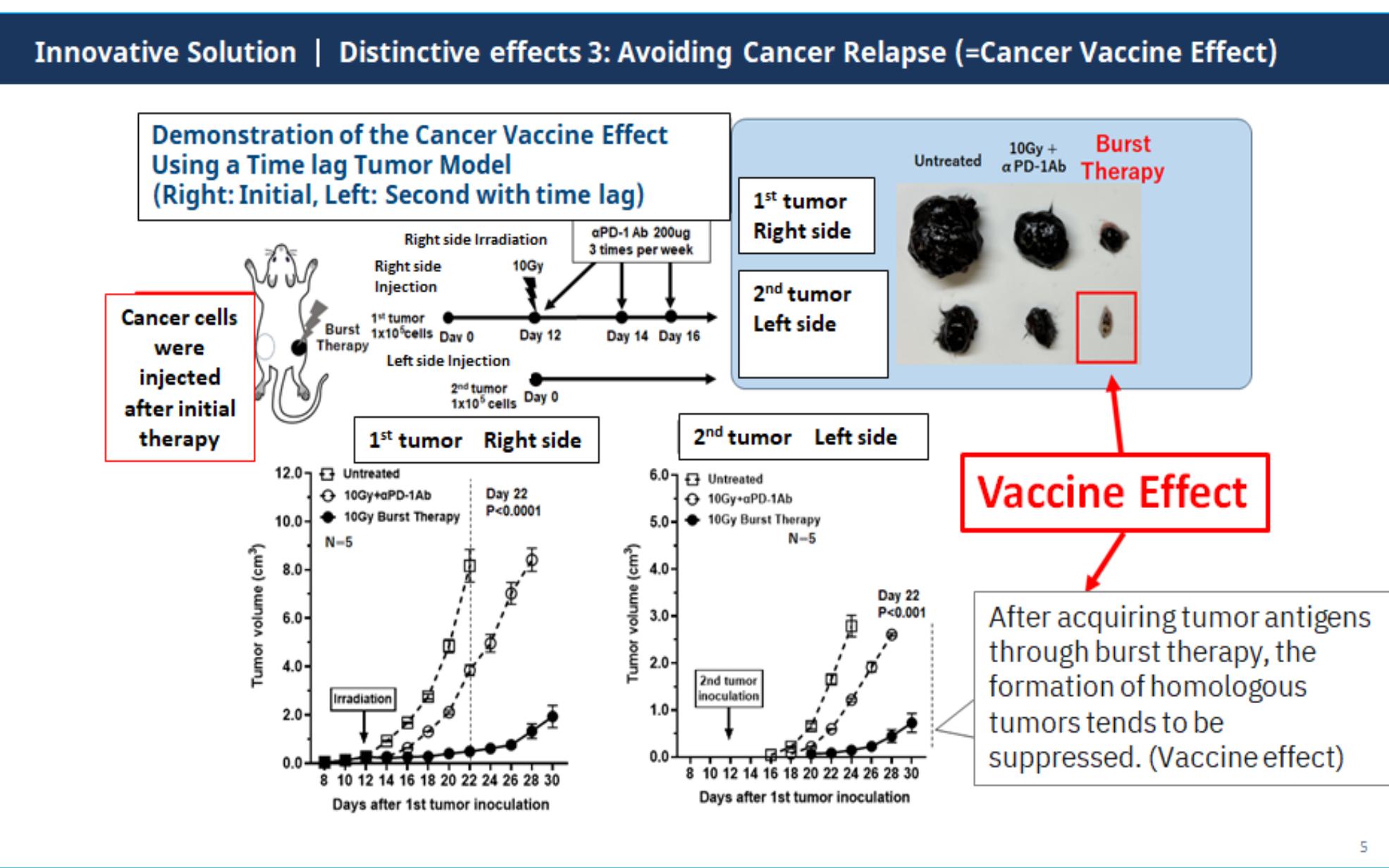
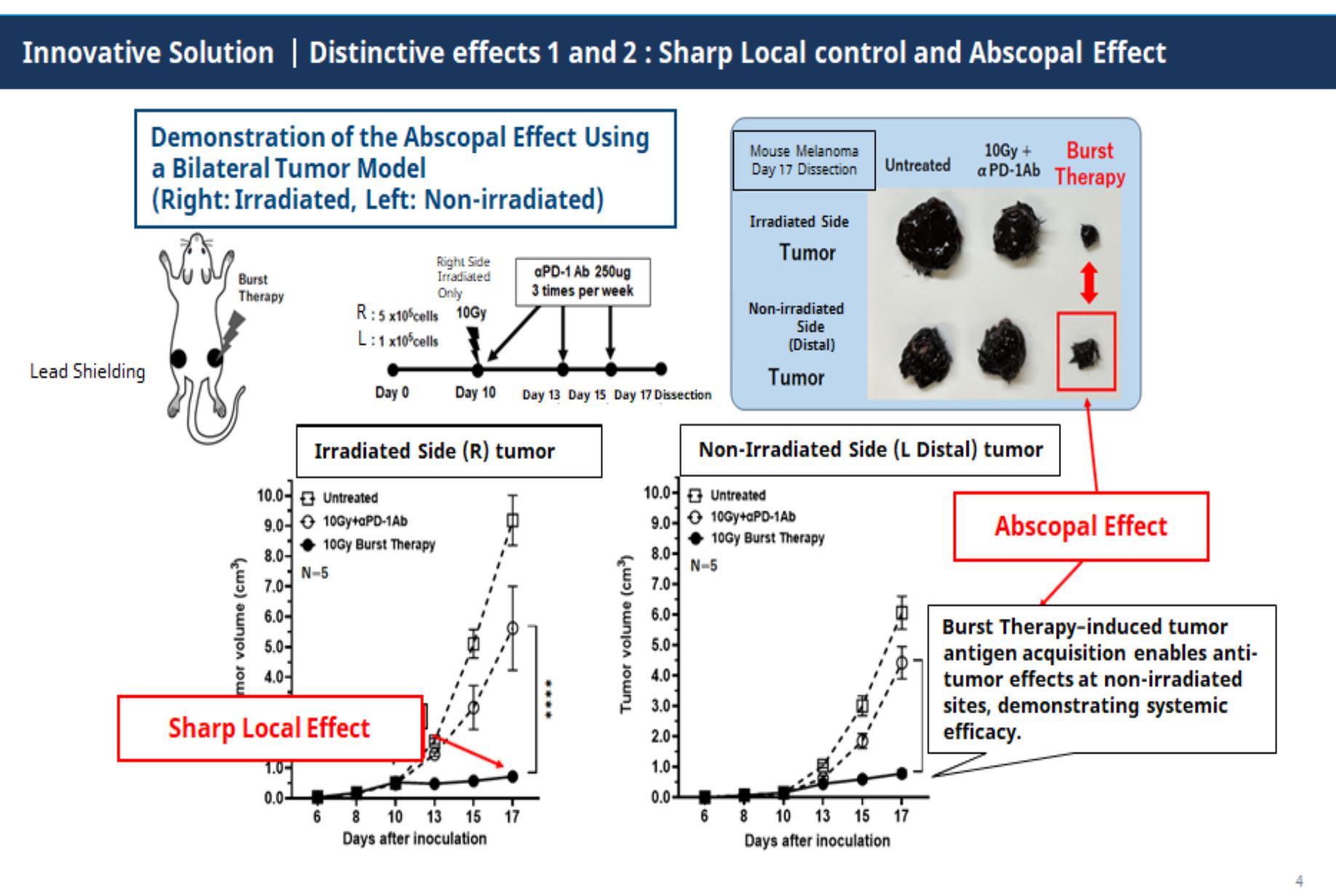
Accelerates Cancer and Immunity cycle

④ Cancer Vaccine Effect



③ Avoidance of Bone Marrow Suppression

## Significant Findings



## Future Prospective

### Business Model Overview

#### R&D Phase:

In-house research and development until preclinical POC

#### Partnership Strategy:

License agreement with major pharmaceutical companies developing immune checkpoint inhibitors after preclinical POC

#### Revenue Model:

Upfront payment, development milestones, and royalties after market launch

#### IP Strategy:

Building patent portfolio for combination therapy of titanium peroxide nanoparticle formulation and immune checkpoint inhibitors

### Market Entry Strategy

**Initial Target:** Radiation-resistant head & neck cancers, sarcomas, and other refractory cancers

**Indication Expansion:** Phased expansion to colorectal and pancreatic cancers

**Regional Deployment:** Priority markets in Japan, US, and Europe

### Potential Partner Companies

<b>Ono Pharmaceutical:</b>	Developer of Opdivo (nivolumab)
<b>MSD:</b>	Developer of Keytruda (pembrolizumab)
<b>Bristol-Myers Squibb:</b>	Developer of Yervoy (ipilimumab)
<b>AstraZeneca:</b>	Developer of Imfinzi (durvalumab)

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## Contact