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Kusuma Wardhani Mas'udah, Pelangi Eka Yuwita, Ahmad Taufiq and Sunaryono

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AIP Conference Proceedings **2231**, 040020 (2020); <https://doi.org/10.1063/5.0002468>

2257 (2020)



2256 (2020)



SHOW ABSTRACT

2255 (2020)



2258 (2020)



 Full . April 2020

2253 (2020)



## Molecular docking studies flavonoid (quercetin, isoquercetin, and kaempferol) of single bulb garlic (*Allium sativum*) to inhibit lanosterol synthase as anti-hypercholesterol therapeutic strategies

2252 (2020)



2251 (2020)



2250 (2020)



2246 (2020)



Maghfiroh Gesty Maharani, Sri Rahayu Lestari and Betty Lukiati

2249 (2020)



AIP Conference Proceedings **2231**, 040021 (2020); <https://doi.org/10.1063/5.0002531>

2248 (2020)



2247 (2020)




SHOW ABSTRACT

2245 (2020)



2244 (2020)



 Full . April 2020

2241 (2020)



## The relationship between

2243 (2020) ∨

2237 (2020) ∨

2242 (2020) ∨

2224 (2020) ∨

2240 (2020) ∨

2239 (2020) ∨

2236 (2020) ∨

2234 (2020) ∨

2238 (2020) ∨

2227 (2020) ∨

2219 (2020) ∨

2235 (2020) ∨

2233 (2020) ∨

2230 (2020) ∨

2220 (2020) ∨

2232 (2020) ∨


2231 (2020) ^

## intestinal parasitic infection and CD<sub>4</sub><sup>+</sup> level among HIV patients in DR. Sardjito Central Hospital, Yogyakarta

Umi Latifah, Supargiyono, Yanri Wijayanti Subronto and Linda Septiani

AIP Conference Proceedings **2231**, 040022 (2020); <https://doi.org/10.1063/5.0002970>

SHOW ABSTRACT


 Full . April 2020


## The potentials of red betel (*Piper crocatum* Ruiz & Pav) terpenoid compounds as *Microsomal Prostaglandin E Synthase-1* (mPGES-1) enzyme inhibitor of rheumatoid arthritis through virtual screening


Solichatul Afifah, Betty Lukiati and Siti Imroatul Maslikah


AIP Conference Proceedings **2231**, 040023 (2020); <https://doi.org/10.1063/5.0002564>


SHOW ABSTRACT


 Full . April 2020


2229 (2020) 


2228 (2020) 


2226 (2020) 


2222 (2020) 


2217 (2020) 


2223 (2020) 


2216 (2020) 


2215 (2020) 


2221 (2020) 


2211 (2020) 


2225 (2020) 

2213 (2020) 

2209 (2020) 

2218 (2020) 

2214 (2020) 


2212 (2020) 

## Utilization of plants as traditional medicine for various diseases: Ethnobotany study in Sumenep, Indonesia

Elly Purwanti, Nurul Mahmudati, Sari Fuji Faradila and Ahmad Fauzi

AIP Conference Proceedings **2231**, 040024 (2020); <https://doi.org/10.1063/5.0002430>

SHOW ABSTRACT


 Full . April 2020

## Fe leaching in the sludge sediment of the Prigi beach with Tessier-Microwave method

Cahyanti Wulan Suci, Anugrah Ricky Wijaya, Aman Santoso and Irma Kartika Kusumaningrum

AIP Conference Proceedings **2231**, 040025 (2020); <https://doi.org/10.1063/5.0002589>

SHOW ABSTRACT

 Full . April 2020

## Coral recruitment at Gili Pandan Island, Gili Genting

2207 (2020) ▼

## District, Sumenep Regency, Indonesia

2210 (2020) ▼

Yulia Andriyani and Wahyu Andy Nugraha

2208 (2020) ▼


AIP Conference Proceedings **2231**, 040026 (2020);  
<https://doi.org/10.1063/5.0002421>

2206 (2020) ▼

SHOW ABSTRACT

2205 (2020) ▼

2204 (2020) ▼

 Full . April 2020

2203 (2020) ▼

### **Influence of *Erythrina cristagalli* L. extract natural dye in plant histology staining**

2197 (2020) ▼

Eko Susetyarini, Sri Wahyuni, Islakhul Kharoir,  
Husamah and Dwi Setyawan

2202 (2019) ▼

2182 (2019) ▼


AIP Conference Proceedings **2231**, 040027 (2020);  
<https://doi.org/10.1063/5.0002620>

2199 (2019) ▼

SHOW ABSTRACT

2198 (2019) ▼

2200 (2019) ▼

 Full . April 2020

2192 (2019) ▼

### ***Curcuma zedoaria*: Potential effect as breast cancer chemotherapeutic agents through CXCR4 inhibition**

2194 (2019) ▼

2201 (2019) ▼

Nur Fitriana, Muhaimin Rifa'i and Widodo

2195 (2019) ▼

2191 (2019) ▼

AIP Conference Proceedings **2231**, 040028 (2020);  
<https://doi.org/10.1063/5.0002629>


2188 (2019) ▼

SHOW ABSTRACT

2196 (2019) ▼

2190 (2019) ▼

2193 (2019) ▼

 Full . April 2020

## **In-silico based analysis of ANGPTL-8 in fibrinogenesis through tumor growth factor $\beta$ -receptor 1 signaling pathway**

Hendra Susanto, I. Kade Karisma Gita Ardana, Melati Putri Pertiwi, Elhah Nailul Khasna, Abdul Ghofur, Adeodatus Yuda Handaya and Nia Lukita Ariani

AIP Conference Proceedings **2231**, 040029 (2020);  
<https://doi.org/10.1063/5.0002473>

2187 (2019) ▼

2186 (2019) ▼

2180 (2019) ▼

2185 (2019) ▼

2183 (2019) ▼


2174 (2019) ▼

SHOW ABSTRACT

2184 (2019) ▼

2177 (2019) ▼

2179 (2019) ▼

 Full . April 2020

## **Morphological and anatomical characteristic of epiphyte ferns in Ronggo Soerjo Botanical Forest**

Eko Sri Sulasmi, Rido Sigit Wicaksono, Sulisetijono, Azizah Nur Rochmah, Hisyam Baidlowi, Koko Murdianto and Kuni Mawaddah

AIP Conference Proceedings **2231**, 040030 (2020);  
<https://doi.org/10.1063/5.0002533>

2178 (2019) ▼

2189 (2019) ▼

2181 (2019) ▼

2176 (2019) ▼

2175 (2019) ▼




2167 (2019) ▼

SHOW ABSTRACT

2171 (2019) ▼

2172 (2019) ▼

 Full . April 2020

2173 (2019) ▼

## **Synthesis of Fe<sub>3</sub>O<sub>4</sub>/α-Fe<sub>2</sub>O<sub>3</sub>/ZnO nanocomposite for antibacterial application**

2169 (2019) ▼

2170 (2019) ▼

Vivian Saly Soplanit, Ahmad Taufiq, Arif Hidayat, Ainun Nikmah, Defi Yuliantika, Habibatun Nurul Ulya and Rosy Eko Saputra

2168 (2019) ▼

AIP Conference Proceedings **2231**, 040031 (2020);  
<https://doi.org/10.1063/5.0002472>


2162 (2019) ▼

2166 (2019) ▼

SHOW ABSTRACT

2165 (2019) ▼

2164 (2019) ▼

 Full . April 2020

2163 (2019) ▼

## **Potential of single bulb garlic (*Allium sativum*) active compound as an 11β-HSD1 inhibitor in obesity through in silico method**

2161 (2019) ▼

2160 (2019) ▼

Qurin Nikmaturrohana, Sri Rahayu Lestari and Betty Lukiati

2159 (2019) ▼

2158 (2019) ▼

AIP Conference Proceedings **2231**, 040032 (2020);  
<https://doi.org/10.1063/5.0002532>

2157 (2019) ▼

SHOW ABSTRACT

2156 (2019) ▼

2153 (2019) ▼

2155 (2019) ▼

2154 (2019) ▼

2152 (2019) ▼

2150 (2019) ▼

2148 (2019) ▼

2151 (2019) ▼

2142 (2019) ▼

2141 (2019) ▼

2147 (2019) ▼

2145 (2019) ▼

2149 (2019) ▼

2139 (2019) ▼


2144 (2019) ▼

2138 (2019) ▼

2146 (2019) ▼

2143 (2019) ▼

2140 (2019) ▼


 Full . April 2020

## Identification of damage and key species of coral reefs on Gili-Noko Bawean Island

Agus Dharmawan, Abiyyu Rahmawan and Anisa Meilia Ashoffi

AIP Conference Proceedings **2231**, 040033 (2020);  
<https://doi.org/10.1063/5.0002579>

SHOW ABSTRACT


 Full . April 2020

## The number of *Escherichia coli* on several flies from residential and landfill areas: *Drosophila* is the least!

Ainur Rofieq, Atok Miftachul Hudha, Elke Ayu Augista and Ahmad Fauzi

AIP Conference Proceedings **2231**, 040034 (2020);  
<https://doi.org/10.1063/5.0002431>

SHOW ABSTRACT

 Full . April 2020

## Protein quality of modified dried skimmed milk coconut

2136 (2019) ▼

## oil (modisco) III formulation with soybean (glycine max) flour addition

2135 (2019) ▼

Galeh Septiar Pontang and Sugeng Maryanto

2137 (2019) ▼

AIP Conference Proceedings **2231**, 040035 (2020);  
<https://doi.org/10.1063/5.0002545>


2134 (2019) ▼

2132 (2019) ▼

SHOW ABSTRACT

2129 (2019) ▼

2131 (2019) ▼

 Full . April 2020

2125 (2019) ▼

## Ethanollic extract of *Centella asiatica* increased IGF-1 and IRS expression in zebrafish (*Danio rerio*) rotenone-induced

2133 (2019) ▼

2130 (2019) ▼

2126 (2019) ▼

Fitra Arsy Nur Cory'ah, Vanda Primaditya, Linda Ika Puspita Ariati, Zakiah, Dyah Woro Kartiko Kusumo Wardani, Dianita Primihastuti, Yuningsih, Husnul Khotimah, Mohammad Muljohadi Ali and Nurdiana more...

2124 (2019) ▼

2116 (2019) ▼

AIP Conference Proceedings **2231**, 040036 (2020);  
<https://doi.org/10.1063/5.0002606>


2128 (2019) ▼

2121 (2019) ▼

SHOW ABSTRACT

2127 (2019) ▼

2123 (2019) ▼

 Full . April 2020

2122 (2019) ▼

## Phytoremediation liquid waste krebet sugar factory

2119 (2019) ▼

## using water spinach (*Ipomoea aquatica*) to decrease BOD and COD levels

2115 (2019) ▼

2120 (2019) ▼

Mimien Henie Irawati Al Muhdhar, Murni Sapta Sari, Dwi Pipit Indriyanti, Sueb and Muhammad Shalahuddin Rahmansyah

2113 (2019) ▼

AIP Conference Proceedings **2231**, 040037 (2020); <https://doi.org/10.1063/5.0007273>

2117 (2019) ▼

2118 (2019) ▼

SHOW ABSTRACT

2111 (2019) ▼

2114 (2019) ▼

 Full . April 2020

2112 (2019) ▼

## Halal material synthesis of Moringa oleifera leaf powder (MOLP) from East Java Indonesia: A preliminary study

2109 (2019) ▼

2110 (2019) ▼

Ahmad Imam Mawardi, Hendra Susanto, Ahmad Taufiq, Dinda Tri Yunisa, Fahdina Rufiandita, Faris Nizarghazi, Gufron Alifi and Lita Neldya Putri

2108 (2019) ▼

2107 (2019) ▼


AIP Conference Proceedings **2231**, 040038 (2020); <https://doi.org/10.1063/5.0002474>

2106 (2019) ▼

SHOW ABSTRACT

2105 (2019) ▼

2102 (2019) ▼


 Full . April 2020

2104 (2019) ▼

## Nicotine prevents weight gain and increases SOD activity in surgically menopausal rat

2103 (2019) ▼

2100 (2019)	∨	Andrew Jonatan, Shelby Amrus Ernanda, Panji Sananta, Ayu Novita Kartikaningtyas, Yanti Marito
2097 (2019)	∨	Parhusip, Ni Putu Frida Baskarani, Nadya Rasty
2098 (2019)	∨	Andhira, Elli Maulidya, Yesi Amelia, Muhammad Vico, more...
2101 (2019)	∨	AIP Conference Proceedings <b>2231</b> , 040039 (2020); <a href="https://doi.org/10.1063/5.0007318">https://doi.org/10.1063/5.0007318</a>
2094 (2019)	∨	SHOW ABSTRACT

2093 (2019)	∨	
2090 (2019)	∨	
2099 (2019)	∨	 Full . April 2020
2096 (2019)	∨	<b>Molecular docking studies of geraniin, corilagin, and ellagic acid from rambutan (<i>Nephelium lappaceum</i> L.) peel extract against squalene synthase as potential anti hypercholesterolemia</b>
2095 (2019)	∨	Lusi Suciati, Sri Rahayu Lestari and Betty Lukiati
2092 (2019)	∨	AIP Conference Proceedings <b>2231</b> , 040040 (2020); <a href="https://doi.org/10.1063/5.0002534">https://doi.org/10.1063/5.0002534</a>
2091 (2019)	∨	
2089 (2019)	∨	
2086 (2019)	∨	SHOW ABSTRACT

2088 (2019)	∨	
2084 (2019)	∨	
2082 (2019)	∨	 Full . April 2020
2078 (2019)	∨	<b>Mangrove conservation and its implication on community life of Bedono Village, Demak,</b>

2085 (2019) ▼

2083 (2019) ▼

2087 (2019) ▼

2080 (2019) ▼

2081 (2019) ▼

2079 (2019) ▼

2075 (2019) ▼

2072 (2019) ▼

2077 (2019) ▼

2076 (2019) ▼

2074 (2019) ▼

2073 (2019) ▼

2070 (2019) ▼

2068 (2019) ▼

2065 (2019) ▼

2060 (2019) ▼

2071 (2019) ▼


2069 (2019) ▼

## Central Java

Andin Irsadi, Sutrisno Anggoro and Tri Retnaningsih  
Soeprbowati

AIP Conference Proceedings **2231**, 040041 (2020);  
<https://doi.org/10.1063/5.0002627>

SHOW ABSTRACT

 Full . April 2020

### **The effect of starter concentration variations and rennet on cheese characteristics of cow milk**

Aman Santoso, Anugrah Ricky Wijaya, Yosida  
Permatasari, Tiara Nur Anisa and Sumari



AIP Conference Proceedings **2231**, 040042 (2020);  
<https://doi.org/10.1063/5.0002557>

SHOW ABSTRACT

 Full . April 2020

### **Virtual screening flavonoid compounds from red betel (*Piper crocatum* Ruiz & Pav.) as inhibitor of cyclooxygenase-2 (COX-2)**

Atikah Amalia, Siti Imroatul Maslikah and Sri Rahayu

2066 (2019)	▼	Lestari
		AIP Conference Proceedings <b>2231</b> , 040043 (2020); <a href="https://doi.org/10.1063/5.0002567">https://doi.org/10.1063/5.0002567</a>
2062 (2019)	▼	
2067 (2019)	▼	SHOW ABSTRACT
2055 (2019)	▼	
2064 (2019)	▼	
		 Full . April 2020
2054 (2019)	▼	<b>Analysis of pollution load carrying capacity of Cibatarua River in Pamulihan District, Garut Regency, West Java</b>
2063 (2019)	▼	Ida Munfarida, Shinfi Wazna Auvaria, Misbakhul Munir and Arya Rezagama
2059 (2019)	▼	AIP Conference Proceedings <b>2231</b> , 040044 (2020); <a href="https://doi.org/10.1063/5.0002732">https://doi.org/10.1063/5.0002732</a>
2057 (2019)	▼	
2061 (2019)	▼	
2058 (2019)	▼	SHOW ABSTRACT
2052 (2018)	▼	
2056 (2018)	▼	
		 Full . April 2020
2050 (2018)	▼	<b>The potency of finger root (<i>Kaempferia pandurata</i> ROXB) rhizome simplicia decoction as anti-fertility of Balb C mice (<i>Mus musculus</i>)</b>
2053 (2018)	▼	Nursasi Handayani, Abdul Gofur and Siti Imroatul Maslikah
2049 (2018)	▼	AIP Conference Proceedings <b>2231</b> , 040045 (2020); <a href="https://doi.org/10.1063/5.0002667">https://doi.org/10.1063/5.0002667</a>
2051 (2018)	▼	
2048 (2018)	▼	


2045 (2018) ▼

SHOW ABSTRACT

2046 (2018) ▼

2040 (2018) ▼

2031 (2018) ▼

 Full . April 2020

2047 (2018) ▼

## **Synthesis and characterization of cobalt oxide nanoparticles using sol-gel method**

2039 (2018) ▼

2043 (2018) ▼

Susanto Arif Sardjono and Poppy Puspitasari

2044 (2018) ▼


AIP Conference Proceedings **2231**, 040046 (2020);  
<https://doi.org/10.1063/5.0002419>

2037 (2018) ▼

SHOW ABSTRACT

2041 (2018) ▼

2038 (2018) ▼

 Full . April 2020

2035 (2018) ▼

## **The diversity of arbuscular mycorrhizal fungi associated with rambutan tangkue cultivar in Lebak, Banten Province**

2036 (2018) ▼

2030 (2018) ▼

Rida Oktorida Khastini, Indah Juwita Sari, Indria Wahyuni and Asep Sumantri

2042 (2018) ▼

2033 (2018) ▼

AIP Conference Proceedings **2231**, 040047 (2020);  
<https://doi.org/10.1063/5.0002812>

2024 (2018) ▼


2022 (2018) ▼

SHOW ABSTRACT



2028 (2018) ▼

2027 (2018) ▼

 Full . April 2020

2034 (2018) ▼

## Potential of *Zingiber officinale* bioactive compounds as inhibitory agent against the IKK-B

2029 (2018) ▼

Wira Eka Putra, Viol Dhea Kharisma and Hendra Susanto

2026 (2018) ▼

2025 (2018) ▼

AIP Conference Proceedings **2231**, 040048 (2020);  
<https://doi.org/10.1063/5.0002478>


2032 (2018) ▼

2023 (2018) ▼

SHOW ABSTRACT

2021 (2018) ▼

2019 (2018) ▼

 Full . April 2020

2020 (2018) ▼

## Can pioneer become invasive?

Vivi Novianti

2013 (2018) ▼

AIP Conference Proceedings **2231**, 040049 (2020);  
<https://doi.org/10.1063/5.0002489>

2017 (2018) ▼

2018 (2018) ▼

SHOW ABSTRACT

2016 (2018) ▼

2015 (2018) ▼

 Full . April 2020

2014 (2018) ▼

## The potency of *Citrus hystrix* DC in increasing fertility: The effect on ovarian follicle in

2011 (2018) ▼

- 2012 (2018) ▼
- 2010 (2018) ▼
- 2008 (2018) ▼
- 2009 (2018) ▼
- 2007 (2018) ▼
- 2006 (2018) ▼
- 2004 (2018) ▼
- 2005 (2018) ▼
- 2001 (2018) ▼
- 2002 (2018) ▼
- 1999 (2018) ▼
- 2003 (2018) ▼
- 2000 (2018) ▼
- 1997 (2018) ▼
- 1998 (2018) ▼
- 1992 (2018) ▼
- 1996 (2018) ▼

## ***Rattus norvegicus***

Eko Susetyarini, Sri Wahyuni, Yatimin and Ahmad Fauzi

AIP Conference Proceedings **2231**, 040050 (2020);  
<https://doi.org/10.1063/5.0002432>

SHOW ABSTRACT

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 Full . April 2020


### **Comparative study of Collembola community on post fire land, transitional land and control land in teak forest Baluran National Park Situbondo**

Suhadi, Agus Dharmawan, Kharirrotun Nafiah, Farid Akhsani and Alifia Yulianita

AIP Conference Proceedings **2231**, 040051 (2020);  
<https://doi.org/10.1063/5.0002694>

SHOW ABSTRACT

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 Full . April 2020

### **Effect of differences in the form of photobioreactor prototypes and aeration**


- 1994 (2018) ∨
- 1993 (2018) ∨
- 1991 (2018) ∨
- 1982 (2018) ∨
- 1995 (2018) ∨
- 1984 (2018) ∨
- 1986 (2018) ∨
- 1989 (2018) ∨
- 1990 (2018) ∨
- 1988 (2018) ∨
- 1987 (2018) ∨
- 1985 (2018) ∨
- 1983 (2018) ∨
- 1980 (2018) ∨
- 1981 (2018) ∨
- 1978 (2018) ∨
- 1979 (2018) ∨
- 1974 (2018) ∨

## period on *Chlorella* sp. cell growth in co-culture with bacteria

Lirofiatillah, Sitoresmi Prabaningtyas, Murni Saptasari, Dhiyudin Aridowi, Mastika Marisahaniulfah, Dwi Listyorini and Eko Agus Suyono

AIP Conference Proceedings **2231**, 040052 (2020); <https://doi.org/10.1063/5.0002527>

SHOW ABSTRACT


 Full . April 2020

## Maternal effect of agronomical characters of F1 soybean derived from panderman variety and CpMMV-resistant soybean lines

Arfiatul Isnaini, Siti Zubaidah and Heru Kuswantoro

AIP Conference Proceedings **2231**, 040053 (2020); <https://doi.org/10.1063/5.0002443>

SHOW ABSTRACT

 Full . April 2020

## Low dose nicotine lower MDA level and does not affect wall

1977 (2018) ▼

## to lumen ratio in surgically menopausal rats

1976 (2018) ▼

Shelby Amrus Ernanda, Panji Sananta, Andrew Jonatan, Ayu Novita Kartikaningtyas, Yanti Marito Parhusip, Ni Putu Frida Baskarani, Nadya Rasty Andhira, Elli Maulidya, Yesi Amelia, Muhammad Vico, more...

1975 (2018) ▼

1971 (2018) ▼

AIP Conference Proceedings **2231**, 040054 (2020); <https://doi.org/10.1063/5.0003164>


1972 (2018) ▼

SHOW ABSTRACT

1973 (2018) ▼

1969 (2018) ▼

1965 (2018) ▼

 Full . April 2020

1970 (2018) ▼

## Morphology, porosity, and biodegradation of PVA/CS/PEG/HAp nanofiber composites as scaffold in bone tissue engineering

1968 (2018) ▼

1967 (2018) ▼

Hartatiek, Yudyanto, Nada Shofura F., Joko Utomo, M. Nurhuda, Dionysius J. D. H. Santjojo and Masrurroh

1966 (2018) ▼

1964 (2018) ▼

AIP Conference Proceedings **2231**, 040055 (2020); <https://doi.org/10.1063/5.0002678>


1961 (2018) ▼

SHOW ABSTRACT

1963 (2018) ▼

1958 (2018) ▼

1953 (2018) ▼

 Full . April 2020

1962 (2018) ✓

1960 (2018) ✓

1959 (2018) ✓

1956 (2018) ✓

1947 (2018) ✓

1946 (2018) ✓

1952 (2018) ✓

1949 (2018) ✓

1943 (2018) ✓

1957 (2018) ✓

1955 (2018) ✓

1950 (2018) ✓

1951 (2018) ✓

1954 (2018) ✓

1942 (2018) ✓

1948 (2018) ✓

1940 (2018) ✓


1945 (2018) ✓

## The growth and distribution pattern of endemic Java palm (*Pinanga javana* Blume) in Mt. Slamet, Central Java, Indonesia

Rizmoon Nurul Zulkarnaen, Nisyawati and Joko Ridho Witono

AIP Conference Proceedings 2231, 040056 (2020); <https://doi.org/10.1063/5.0002814>

SHOW ABSTRACT


 Full . April 2020

## Analysis of peroxide value, free fatty acid, and water content changes in used cooking oil from street vendors in Malang

Rina Rifqie Mariana, Evi Susanti, Laili Hidayati and Roswanira Abdul Wahab

AIP Conference Proceedings 2231, 040057 (2020); <https://doi.org/10.1063/5.0002656>

SHOW ABSTRACT

 Full . April 2020

## Feed preference based on


- 1944 (2018) ▼
- 1941 (2018) ▼
- 1939 (2018) ▼
- 1938 (2018) ▼
- 1937 (2018) ▼
- 1936 (2018) ▼
- 1935 (2018) ▼
- 1932 (2018) ▼
- 1933 (2018) ▼
- 1931 (2018) ▼
- 1927 (2018) ▼
- 1934 (2018) ▼
- 1930 (2018) ▼
- 1928 (2018) ▼
- 1929 (2018) ▼
- 1924 (2018) ▼
- 1926 (2018) ▼

## **faeces composition analysis green peafowl (*Pavo muticus* Linnaeus, 1766) in Bekol Savanna Baluran National Park**

Agus Dharmawan, Suhadi, Anisa Meilia Ashoffi and  
Riri Wiyanti Retnaningtyas

AIP Conference Proceedings **2231**, 040058 (2020);  
<https://doi.org/10.1063/5.0002665>

SHOW ABSTRACT


 Full . April 2020

## **The effect of extrusion speed on mechanical properties of starch-based biocomposite**

Heru Suryanto, Didan Aditya Dwi Fitrasakti, Aditya  
Rizky Ramadhani, Agus Suyetno and Aminnudin

AIP Conference Proceedings **2231**, 040059 (2020);  
<https://doi.org/10.1063/5.0002524>

SHOW ABSTRACT

 Full . April 2020

## **The blight-resistance gene response to bacterial leaf blight disease in isogenic varieties through**

1920 (2018) ▼

## pathogenicity test

Indra Kurniawan Saputra, I. Made Artika and Tasliah

AIP Conference Proceedings **2231**, 040060 (2020);

<https://doi.org/10.1063/5.0002644>

1925 (2018) ▼


1923 (2018) ▼

1922 (2018) ▼

SHOW ABSTRACT

1921 (2018) ▼

1918 (2017) ▼

 Full . April 2020

1919 (2017) ▼

## Application of bioinformatics in the analysis of heavy oil degradation gene in *Bacillus subtilis*

1917 (2017) ▼

1914 (2017) ▼

Kennis Rozana

1915 (2017) ▼

AIP Conference Proceedings **2231**, 040061 (2020);

<https://doi.org/10.1063/5.0002496>


1916 (2017) ▼

1912 (2017) ▼

SHOW ABSTRACT

1910 (2017) ▼

1913 (2017) ▼

 Full . April 2020

1911 (2017) ▼

## Study of morphological variations of *Gekko gekko* (Linnaeus 1758) population in Indonesia

1901 (2017) ▼

1909 (2017) ▼

Shohib Manzili, Ibrohim and Amir Hamidy

1908 (2017) ▼

AIP Conference Proceedings **2231**, 040062 (2020);

<https://doi.org/10.1063/5.0002491>


1906 (2017) ▼

SHOW ABSTRACT

1904 (2017) ▼

1905 (2017) ▼

1898 (2017) ▼

 Full . April 2020

## **Synchronization of heart sounds with pulse from dorsalis pedis for S1 and S2 detection**

1907 (2017) ▼

1903 (2017) ▼

Aripriharta, Muladi, Ilham Ari Elbaith Zaeni, I. Made Irawan, Adim Firmansah, Akhmad Afrizal Rizqi and Gwo Jiun Horng

1902 (2017) ▼

1900 (2017) ▼

AIP Conference Proceedings **2231**, 040063 (2020); <https://doi.org/10.1063/5.0002599>


1899 (2017) ▼

1893 (2017) ▼

SHOW ABSTRACT

1897 (2017) ▼

1896 (2017) ▼

 Full . April 2020

## **Synthesis and characterization of CIGS/ZnO film by spin coating method for solar cell application**

1894 (2017) ▼

1892 (2017) ▼

Atika S. P. Dewi, Nandang Mufti, Arramel, Bagas Haqi Arrosyid, Sunaryono and Aripriharta

1895 (2017) ▼

1890 (2017) ▼

AIP Conference Proceedings **2231**, 040064 (2020); <https://doi.org/10.1063/5.0002493>

1891 (2017) ▼


1887 (2017) ▼

SHOW ABSTRACT



1882 (2017) ▼

1886 (2017) ▼

 Full . April 2020

1885 (2017) ▼

**Aromatherapy oils of lavender  
(*Lavandula angustifolia*)  
inhalance reduced  
norepinephrine levels of  
woman with postpartum blues  
based on Edinburgh  
postpartum depression scale**

1889 (2017) ▼

1888 (2017) ▼

1878 (2017) ▼

1883 (2017) ▼

Erna Amin, Bambang Rahardjo and Kusworini

AIP Conference Proceedings **2231**, 040065 (2020);  
<https://doi.org/10.1063/5.0003654>


1874 (2017) ▼

1884 (2017) ▼

SHOW ABSTRACT

1880 (2017) ▼

1877 (2017) ▼

 Full . April 2020

1881 (2017) ▼

**Insect communities in open  
and closed canopy in  
monsoon forest, Baluran  
National Park, Situbondo Jawa  
Timur**

1872 (2017) ▼

1879 (2017) ▼

1876 (2017) ▼

Fatchur Rohman, Danial Mursyd, Suhadi, Agus  
Dharmawan and Purwanto

1871 (2017) ▼

AIP Conference Proceedings **2231**, 040066 (2020);  
<https://doi.org/10.1063/5.0002523>


1869 (2017) ▼

1875 (2017) ▼

SHOW ABSTRACT

1870 (2017) ▼

1868 (2017) ▼

 Full . April 2020

1873 (2017) ▼

## **Effect of decoction simplicia pulutan (*Urena lobata* L.) leaves against the number of follicles strains Balb-C mice**

1867 (2017) ▼

1864 (2017) ▼

Nursasi Handayani, Dinda Aprilia, Amy Tenzer and Abdul Gofur

1857 (2017) ▼

AIP Conference Proceedings **2231**, 040067 (2020); <https://doi.org/10.1063/5.0002669>


1866 (2017) ▼

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SHOW ABSTRACT

1863 (2017) ▼

1859 (2017) ▼

 Full . April 2020

1860 (2017) ▼

## **The morphological profiling of Indonesian frizzle chicken: A preliminary study of Javanese *Gallus gallus domesticus***

1861 (2017) ▼

1862 (2017) ▼

Moch. Sholeh, Hendra Susanto, Fatma Yuni Reformawati, Nadilah Nur Anggraeni, Fitriana Hadayani, Farida Ariyani, Bay Ummu Sakinatuz Zakiah, Annisah Rachmawati Ariyadi, Sayli Salsabila, more...

1858 (2017) ▼

1852 (2017) ▼

AIP Conference Proceedings **2231**, 040068 (2020); <https://doi.org/10.1063/5.0002479>


1850 (2017) ▼

1854 (2017) ▼

SHOW ABSTRACT

1851 (2017) ▼

1855 (2017) ▼

 Full . April 2020

1856 (2017) ▼

**Culturable endophytic bacteria obtained from *Cinchona Ledgeriana* Moens. in West Java and its antagonistic effect against *Phytophthora* sp.**

1853 (2017) ▼

1836 (2017) ▼

1849 (2017) ▼

Fauzi Akhbar Anugrah, Rahmi Masita, Hanumi Oktyani Rusdi and Satrio Anggoro Putra

1841 (2017) ▼

AIP Conference Proceedings **2231**, 040069 (2020); <https://doi.org/10.1063/5.0002492>


1848 (2017) ▼

1840 (2017) ▼

SHOW ABSTRACT

1847 (2017) ▼

1832 (2017) ▼

 Full . April 2020

1846 (2017) ▼

**Effect of *Centella asiatica* to the glucose transporter 4 and osteocalcin on the rotenone-induced zebrafish larvae (*Danio rerio*) stunting model**

1844 (2017) ▼

1842 (2017) ▼

Vanda Primaditya, Fitra Arsy Nur Cory'ah, Linda Ika Puspita Ariati, Zakiah, Dyah Woro Kartiko Kusumo Wardani, Yuningsih, Dianita Primihastuti, Husnul Khotimah, Mohammad Muljohadi Ali and Wibi more...

1845 (2017) ▼

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AIP Conference Proceedings **2231**, 040070 (2020); <https://doi.org/10.1063/5.0002607>

1843 (2017) ▼

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SHOW ABSTRACT

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1808 (2017) ▼

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 Full . April 2020

## **Contamination of shrimp pond waste: The impact on macrozoobenthos diversity**

Wahyu Prihanta, Facischa Ayu Irvindari, Elly Purwanti, Abdulkadir Rahardjanto and Fuad Jaya Miharja

AIP Conference Proceedings **2231**, 040071 (2020);  
<https://doi.org/10.1063/5.0002617>

SHOW ABSTRACT

 Full . April 2020

## **Characteristics of crystal structure and microwave absorption of silica particles as the effect of sintering temperature**

Kusuma Wardhani Mas'udah, Hendy and Ahmad Taufiq

AIP Conference Proceedings **2231**, 040072 (2020);  
<https://doi.org/10.1063/5.0002477>

SHOW ABSTRACT

1819 (2017) ✓

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1800 (2017) ✓


 Full . April 2020

## **Amylolytic activity of bacterial strains isolated from sago pulp of the traditional sago industry in Palopo, South Sulawesi**

Uswatun Hasanah, Tri Ardyati and Prilya Dewi  
Fitriasari

AIP Conference Proceedings **2231**, 040073 (2020);  
<https://doi.org/10.1063/5.0002487>

SHOW ABSTRACT

 Full . April 2020

## **The potency of flavonoid n-hexane, chloroform, and ethanolic fraction from *Scurrula atropurpurea* (Blume) danser on proliferation and apoptosis through methylation of p16 gene on HeLa cells**

Ni Luh Putu Eka Sudiwati, Tatit Nurseta, Aulanni'am  
Aulanni'am and Mulyohadi Ali

AIP Conference Proceedings **2231**, 040074 (2020);  
<https://doi.org/10.1063/5.0007313>

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1795 (2017) ▼

1802 (2017) ▼

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 Full . April 2020

## Diversity of molluscs in the mangrove forest area of Cengkong Beach-Trenggalek


Abdulkadir Rahardjanto, Veti Rizky Tosiyana, H. Husamah and Fuad Jaya Miharja

AIP Conference Proceedings **2231**, 040075 (2020);  
<https://doi.org/10.1063/5.0002618>

SHOW ABSTRACT

1788 (2017) ▼

1791 (2016) ▼

 Full . April 2020

## Exploration of the leached Fe geochemical fractions in Tiga Warna Beach sediment, Indonesia

Anugrah Ricky Wijaya, Sabtin Maulidiyah Hani, Moh. Shodiq Ibnu and Muntholib Muntholib

AIP Conference Proceedings **2231**, 040076 (2020);  
<https://doi.org/10.1063/5.0002591>


SHOW ABSTRACT

1786 (2016) ▼

1783 (2016) ▼

1787 (2016) ▼

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 Full . April 2020

## Antiviral activity of agarwood *Aquilaria malaccensis* lamk

1777 (2016) ▼

1781 (2016) ▼

**and *Gyrinops versteegii* (Gilg.)  
Domke leaves ethanolic  
extract against dengue  
serotype 3 virus *in vitro***

Rahmi Masita, Tri Rini Nuringtyas, Nastiti Wijayanti  
and Lisna Hidayati

1778 (2016) ▼

1782 (2016) ▼

1775 (2016) ▼

AIP Conference Proceedings **2231**, 040077 (2020);  
<https://doi.org/10.1063/5.0002645>


1780 (2016) ▼

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SHOW ABSTRACT

1774 (2016) ▼

1769 (2016) ▼

 Full . April 2020

1773 (2016) ▼

**The exploration of medicinal  
plants' phytochemical  
compounds as potential  
inhibitor against human  $\alpha$ -3  
nicotinic acetylcholine  
receptors: The insight from  
computational study**

1772 (2016) ▼

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Wira Eka Putra, Viol Dhea Kharisma and Hendra  
Susanto

1768 (2016) ▼

1767 (2016) ▼

AIP Conference Proceedings **2231**, 040078 (2020);  
<https://doi.org/10.1063/5.0002480>


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 Full . April 2020

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1745 (2016) ▾

1740 (2016) ▾

1749 (2016) ▾

1751 (2016) ▾


1750 (2016) ▾

## **Blood glucose profile in healthy adults with *Nasi jagung* consumption habit**

Indri Mulyasari and Sugeng Maryanto

AIP Conference Proceedings **2231**, 040079 (2020);  
<https://doi.org/10.1063/5.0002647>

SHOW ABSTRACT


 Full . April 2020

## **Where do bioactive compounds accumulate in fern? A histochemical analysis of seven therapeutic pteris from Tahura Soeryo**

Sulisetijono, Eko Sri Sulasmi, Murni Sapta Sari and Kuni Mawaddah

AIP Conference Proceedings **2231**, 040080 (2020);  
<https://doi.org/10.1063/5.0002439>

SHOW ABSTRACT

 Full . April 2020

## **Antibacterial activity of potassium salt, fatty acids, and methyl esters of candlenut seed oil against**



1743 (2016) ▼

## ***Staphylococcus aureus* and *Escherichia coli***

1748 (2016) ▼

Sutrisno, Rensa Dwi Assyfhah, Rini Retnosari, Ihsan  
Budi Rachman and Husni Wahyu Wijaya

1747 (2016) ▼

AIP Conference Proceedings **2231**, 040081 (2020);  
<https://doi.org/10.1063/5.0002553>


1746 (2016) ▼

SHOW ABSTRACT

1744 (2016) ▼

1742 (2016) ▼

1738 (2016) ▼

 Full . April 2020

## **Secondary metabolites production of epigallocatechin gallate through in *vitro* culture of *Camellia sinensis* l with cinnamic acid precursors**

1737 (2016) ▼

1739 (2016) ▼

1734 (2016) ▼

Sutini, Widiwurjani, Nora Augustien, Djoko Agus  
Purwanto and Wirdhatul Muslihatin

1735 (2016) ▼

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AIP Conference Proceedings **2231**, 040082 (2020);  
<https://doi.org/10.1063/5.0002565>


1736 (2016) ▼

SHOW ABSTRACT

1732 (2016) ▼

1730 (2016) ▼

1728 (2016) ▼

 Full . April 2020

## **Investigation of carbon phase structure of corncob charcoal powder**

1727 (2016) ▼

1729 (2016) ▼

1725 (2016)



Pelangi Eka Yuwita, Kusuma Wardhani Mas'udah,  
Sunaryono and Ahmad Taufiq

AIP Conference Proceedings **2231**, 040083 (2020);  
<https://doi.org/10.1063/5.0002451>

1726 (2016)



1724 (2016)




SHOW ABSTRACT

1723 (2016)



1717 (2016)



 Full . April 2020

1722 (2016)



## **Anticancer potential of holothurin A, holothurin B, and holothurin B3 from the sea cucumber *Holothuria scabra***

1721 (2016)



**Teresa Liliana Wargasetia**, Hana Ratnawati and Nashi  
Widodo

1720 (2016)



AIP Conference Proceedings **2231**, 040084 (2020);  
<https://doi.org/10.1063/5.0002552>

1718 (2016)



1719 (2016)



1715 (2016)



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1713 (2016)



1716 (2016)



 Full . April 2020

1712 (2016)



## **The active compounds composition and antifeedant activity of leaf extract of two cultivar *Carica papaya* L. on *Spodoptera litura* F. larvae**

1714 (2016)



1711 (2016)



1707 (2016)



Sofia Ery Rahayu, Amin Setyo Leksono, Zulfaidah  
Penata Gama and Hagus Tarno

1706 (2016)



AIP Conference Proceedings **2231**, 040085 (2020);

1710 (2016) ▼

SHOW ABSTRACT

1708 (2016) ▼

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1704 (2016) ▼

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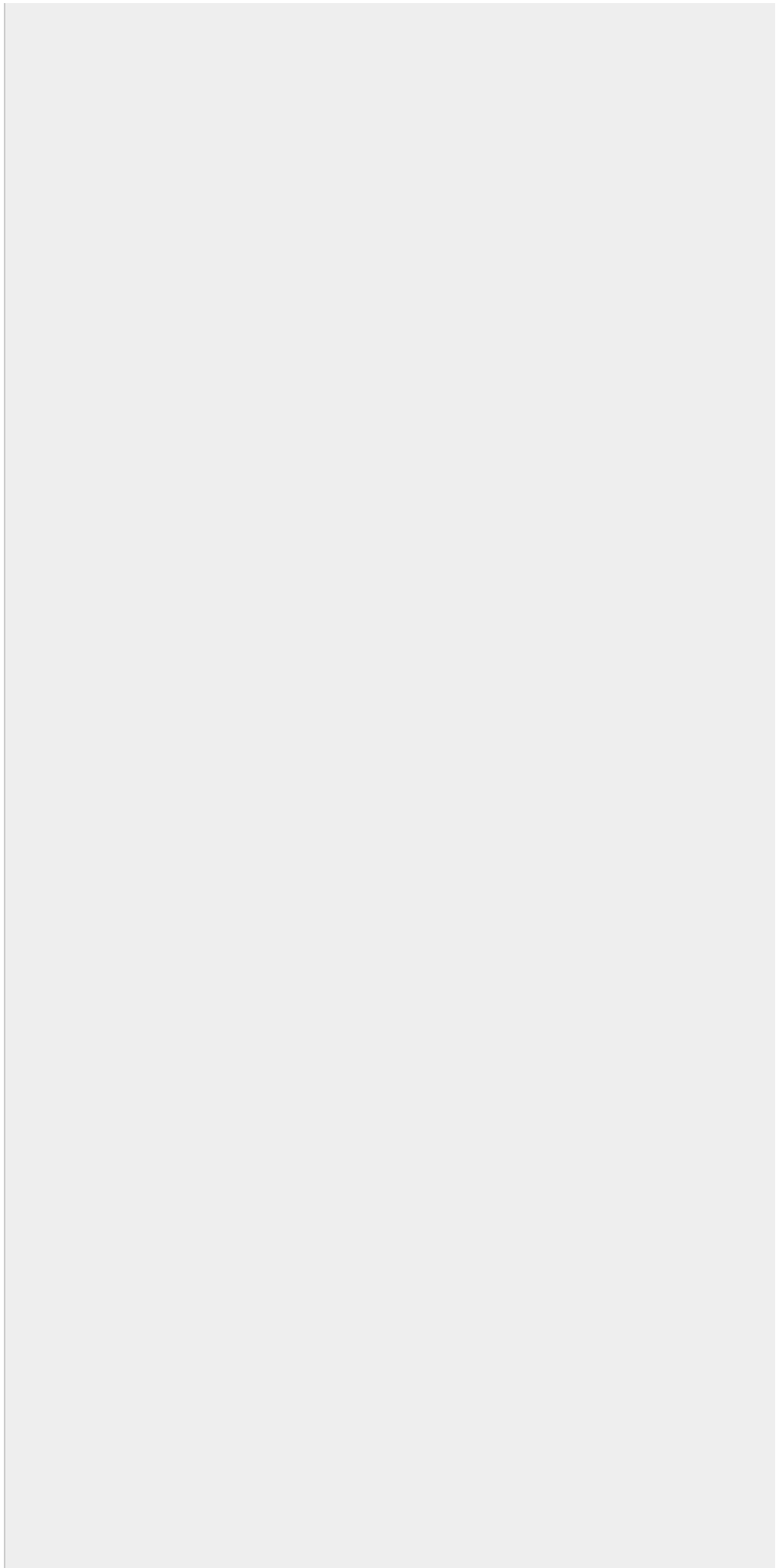
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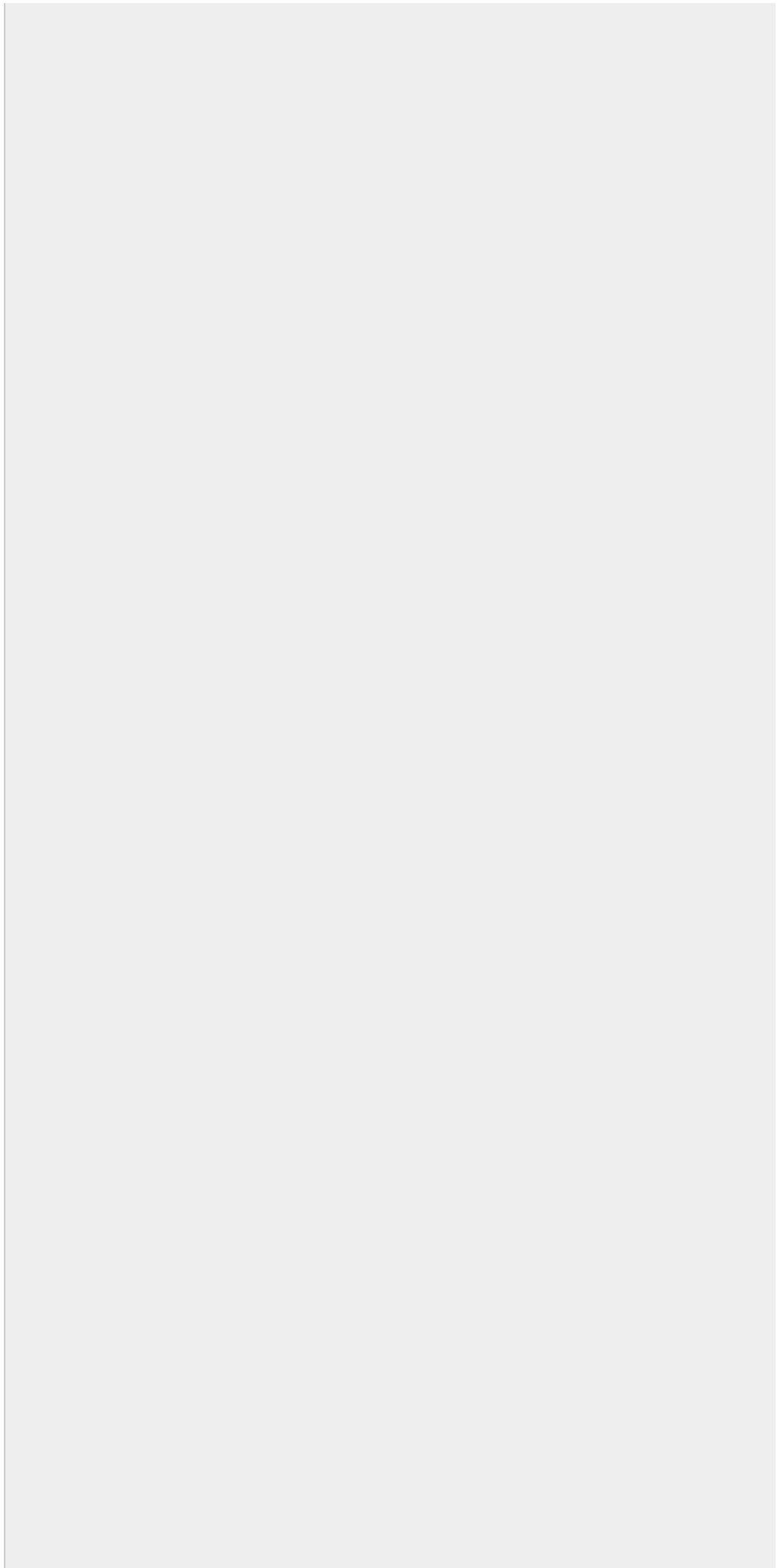
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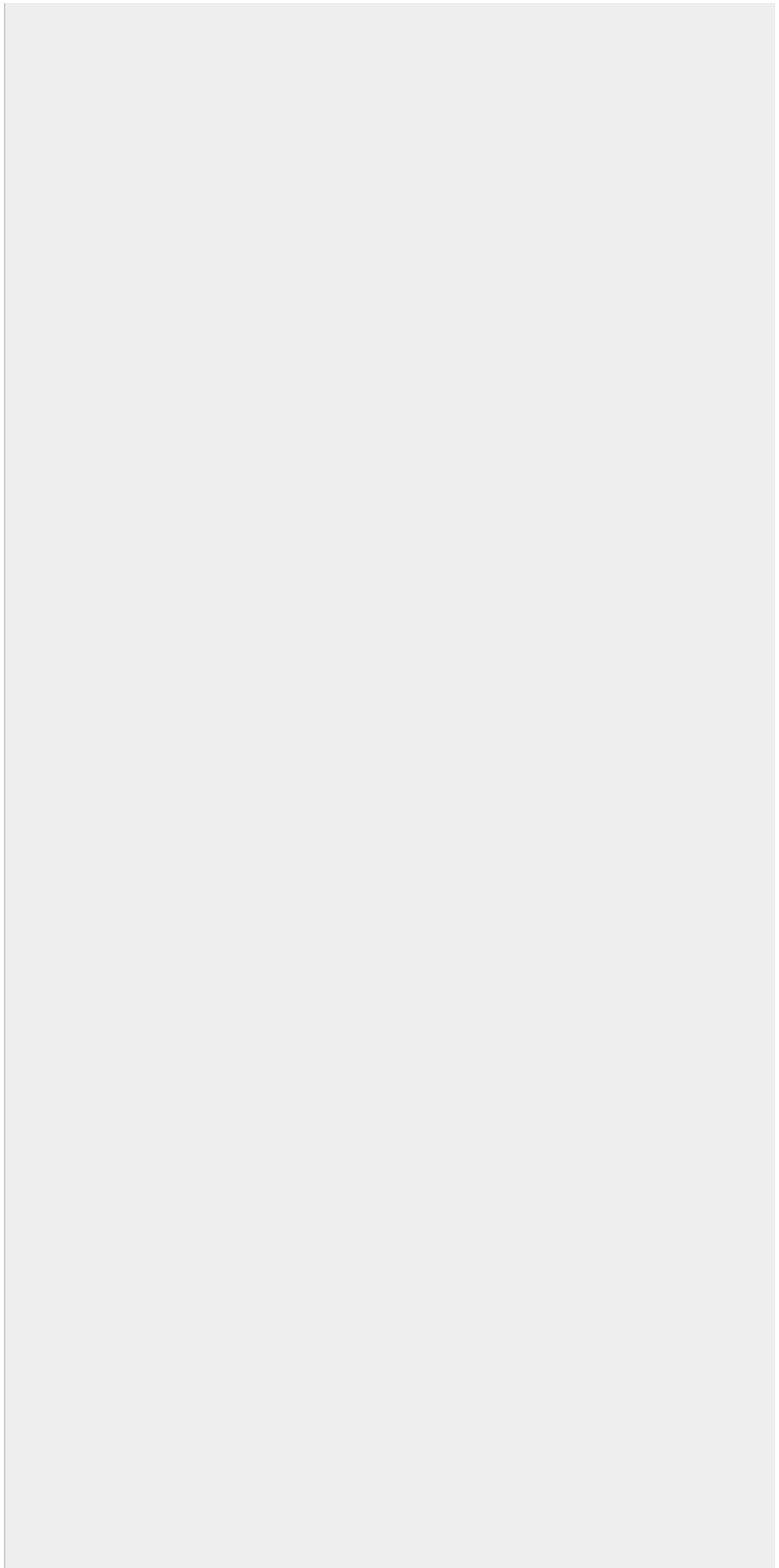
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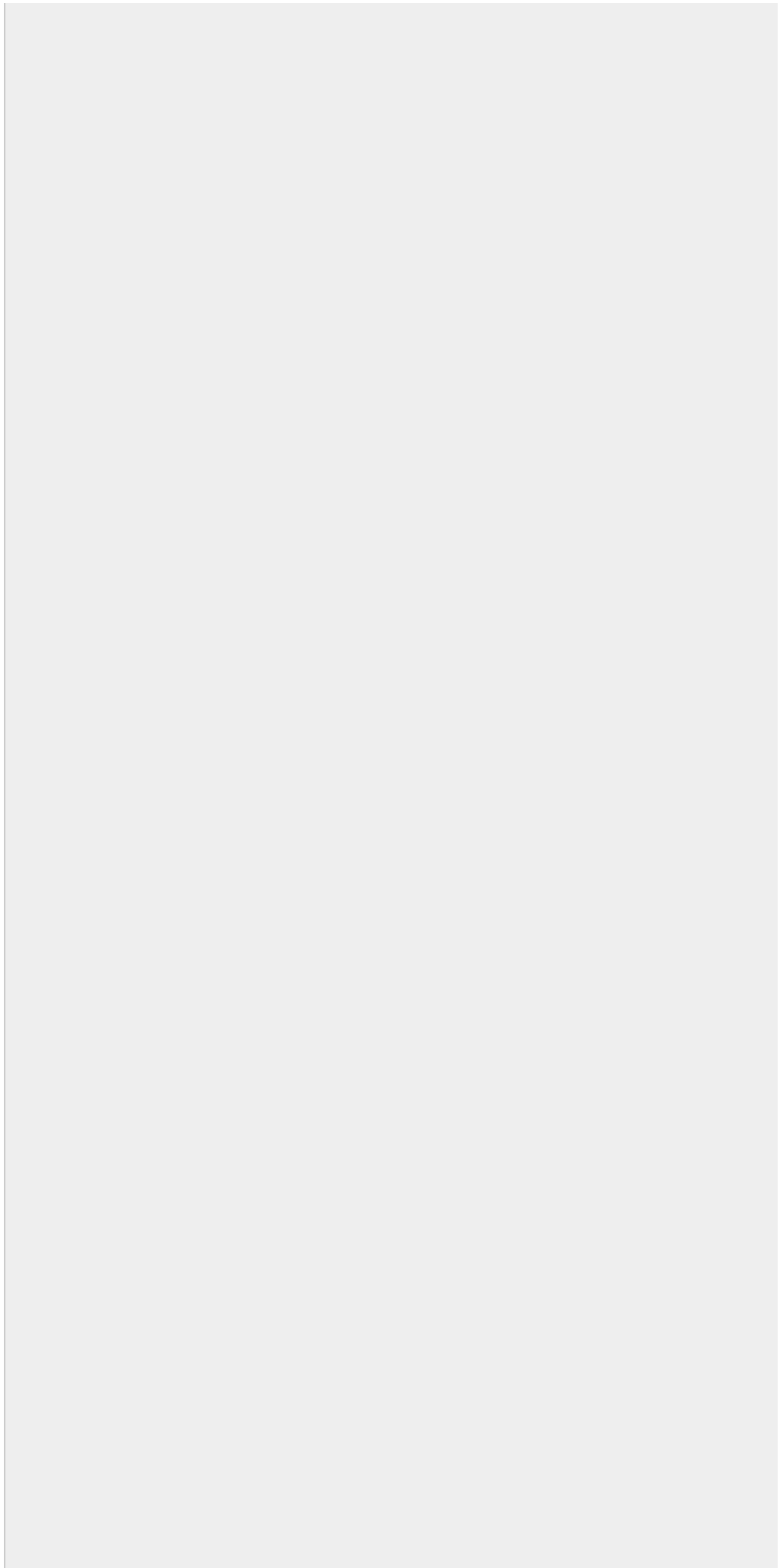
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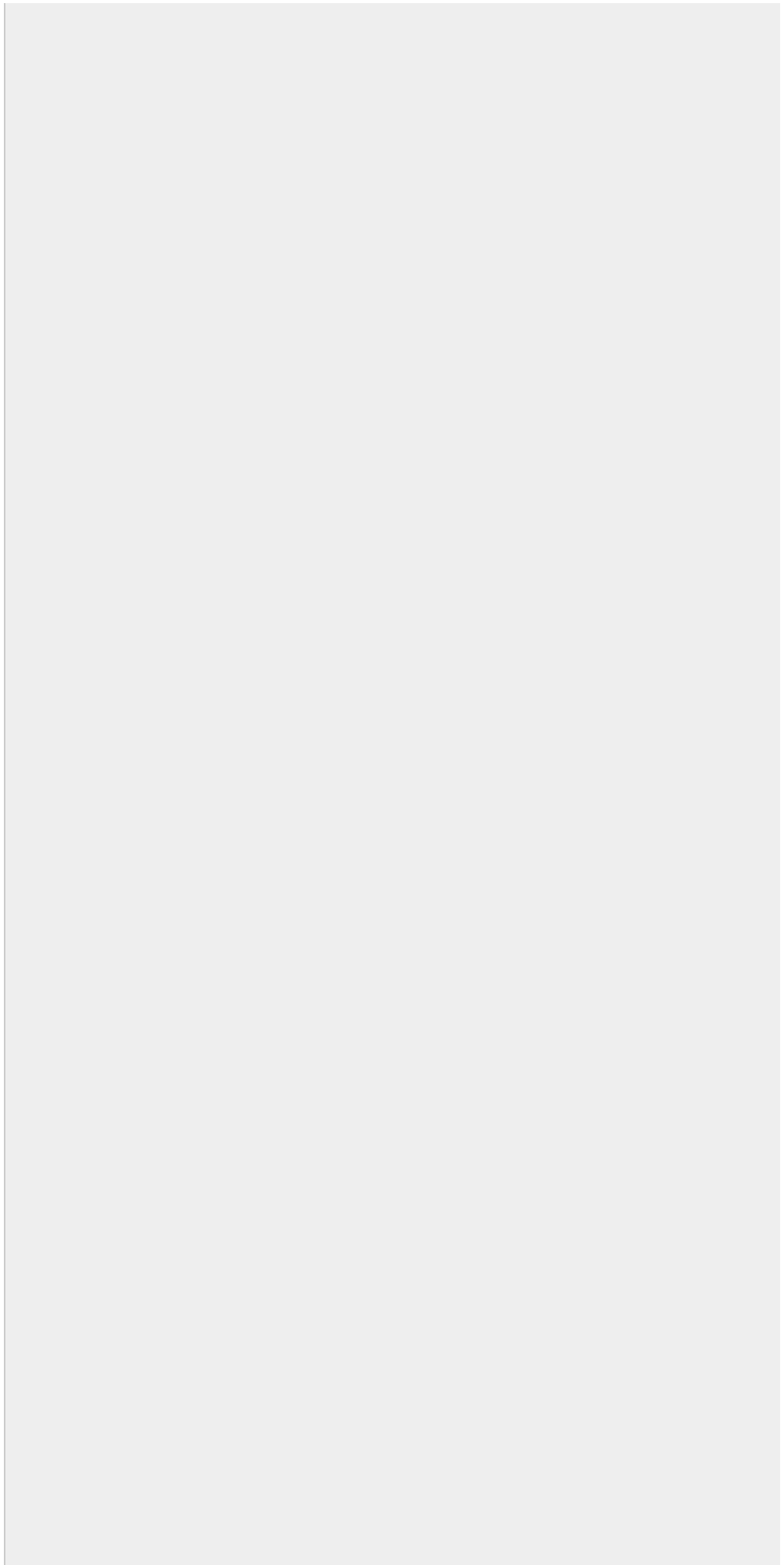
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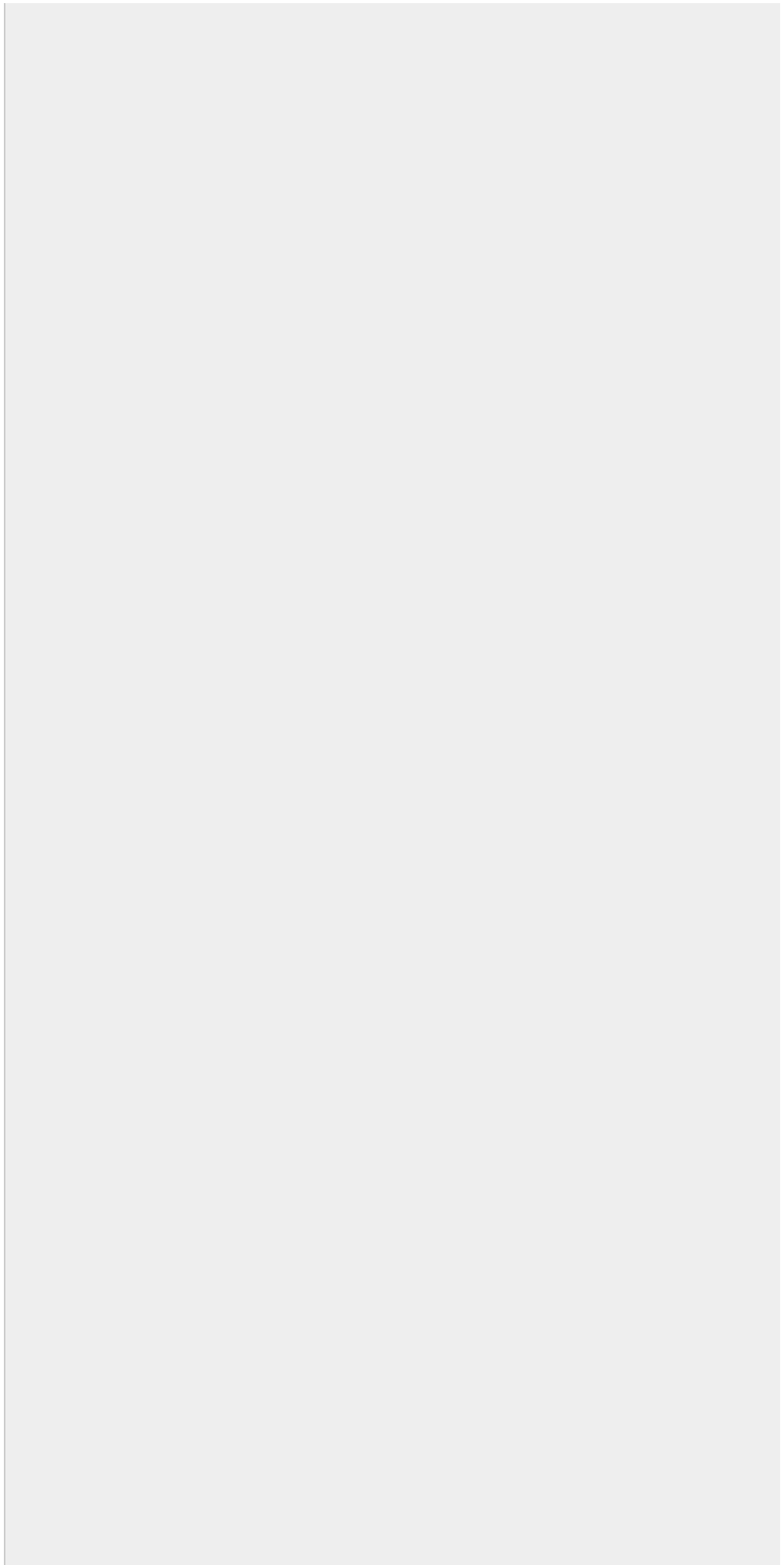


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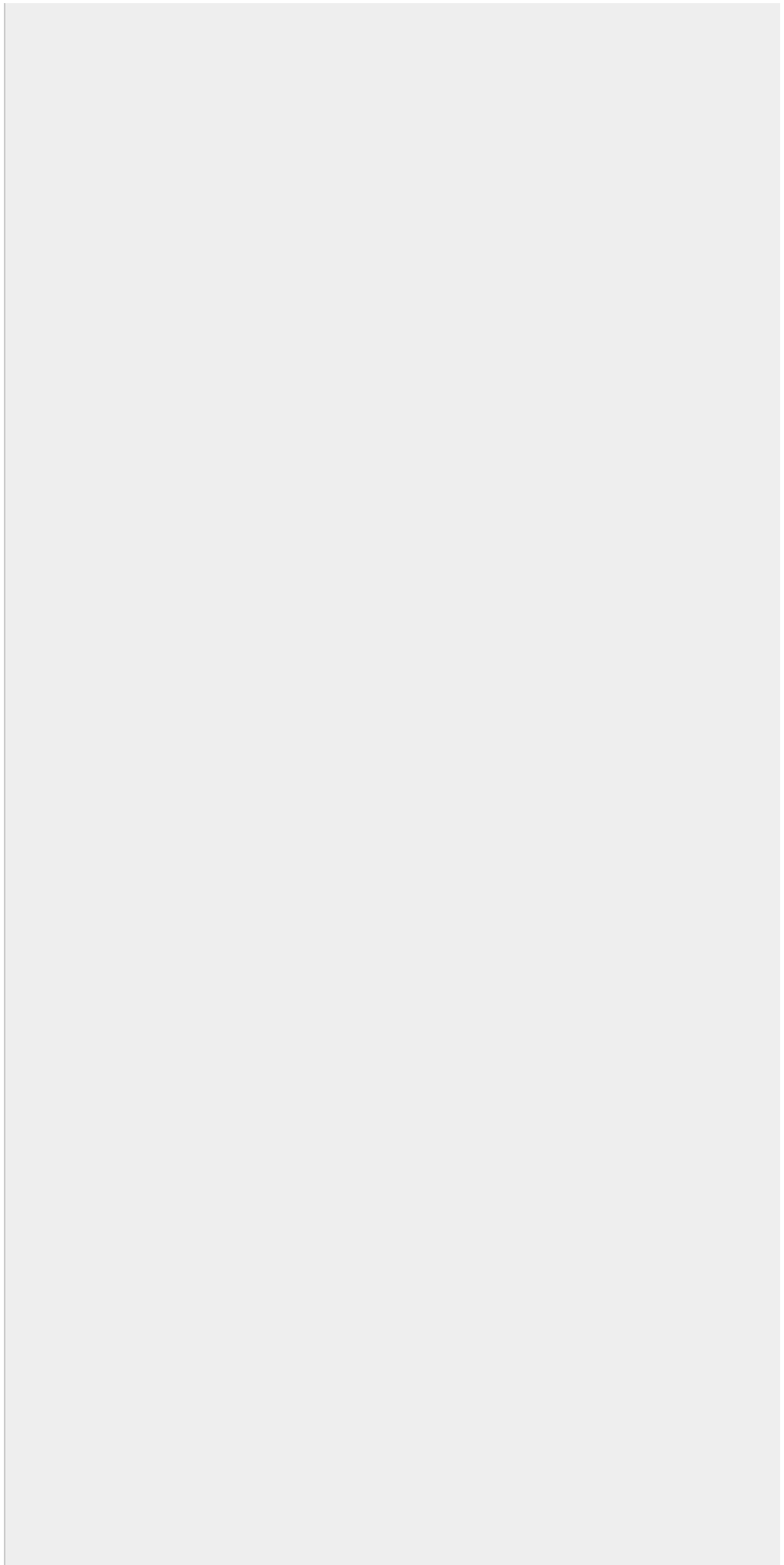




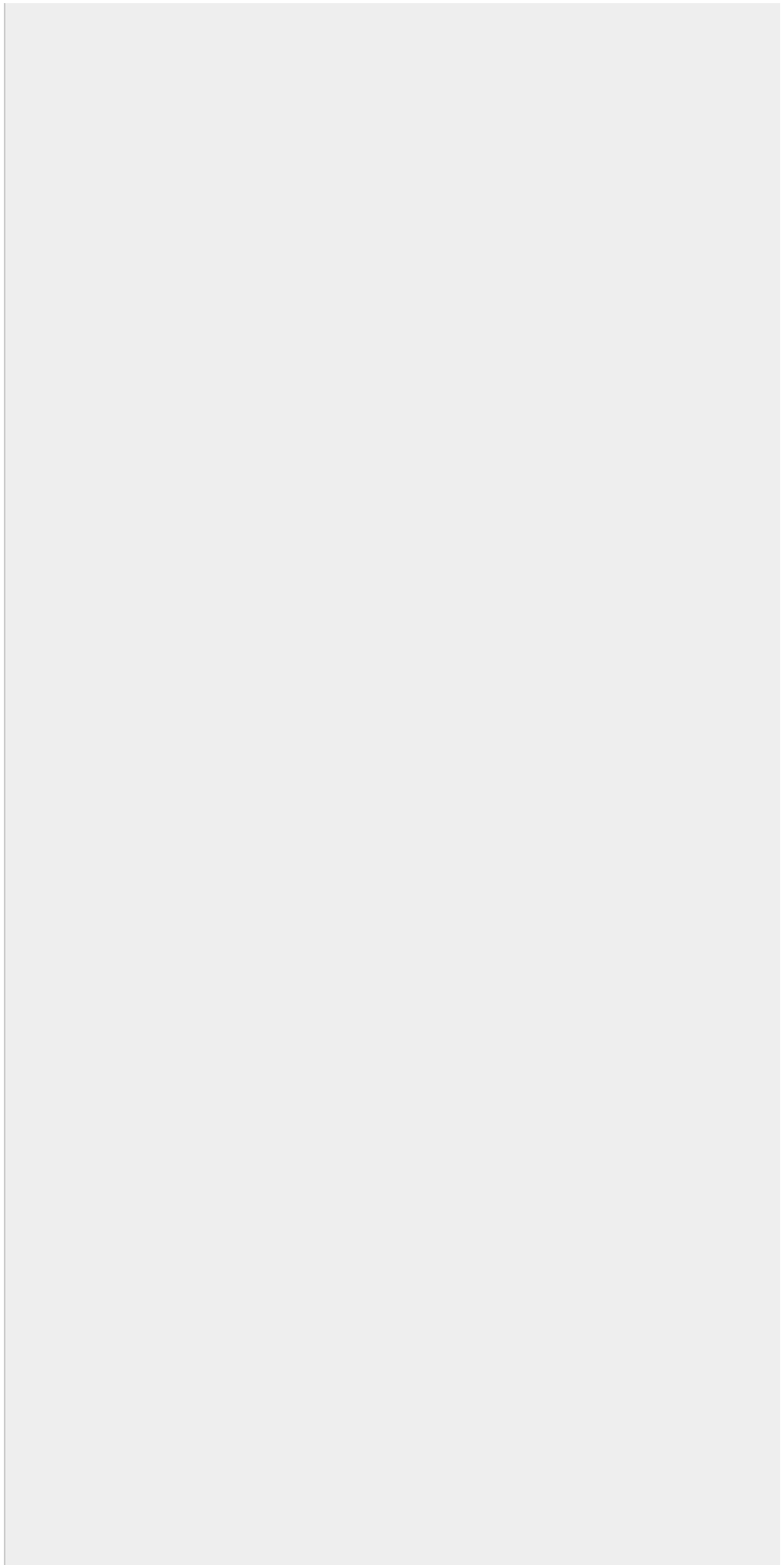
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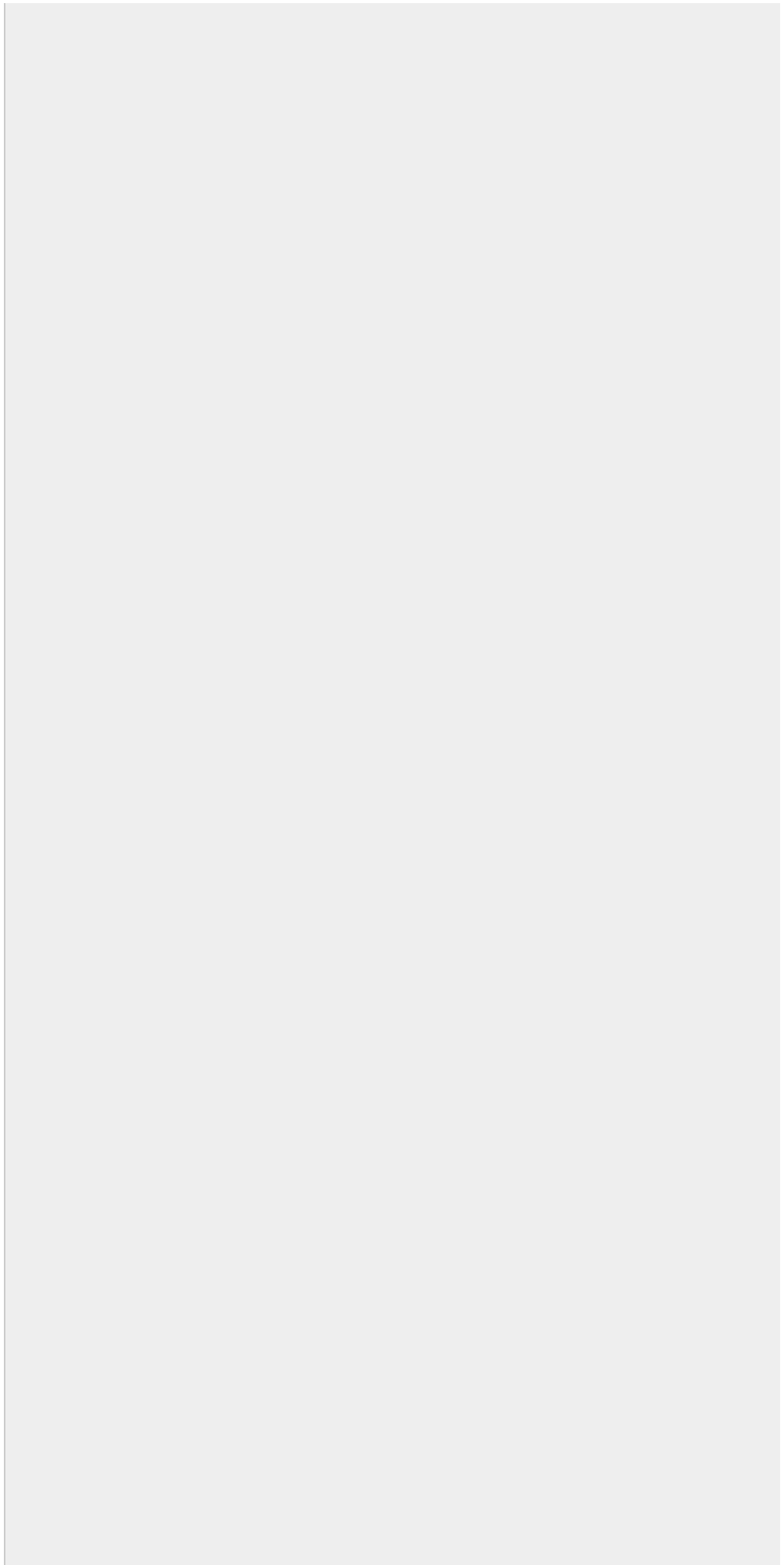
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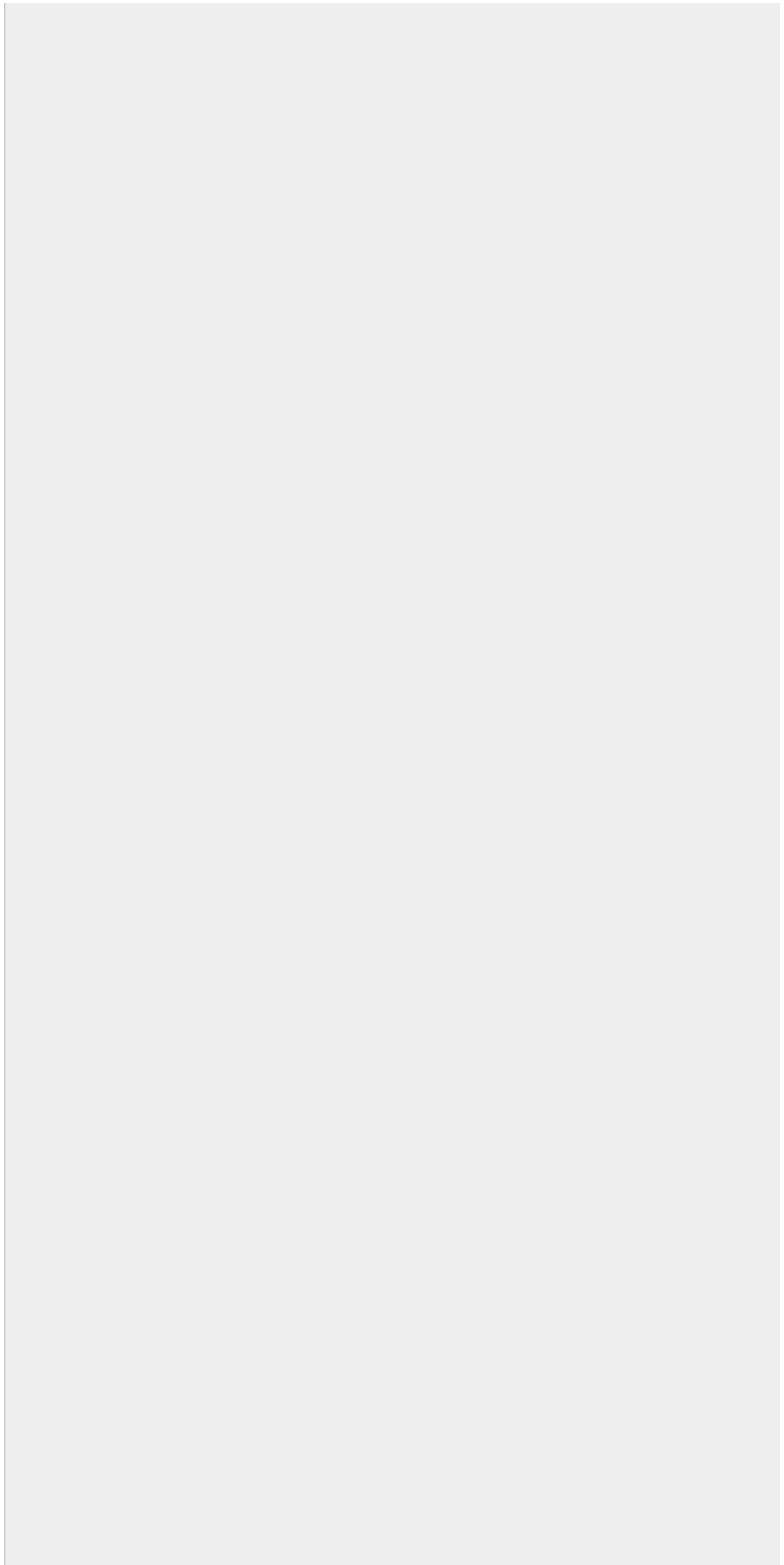
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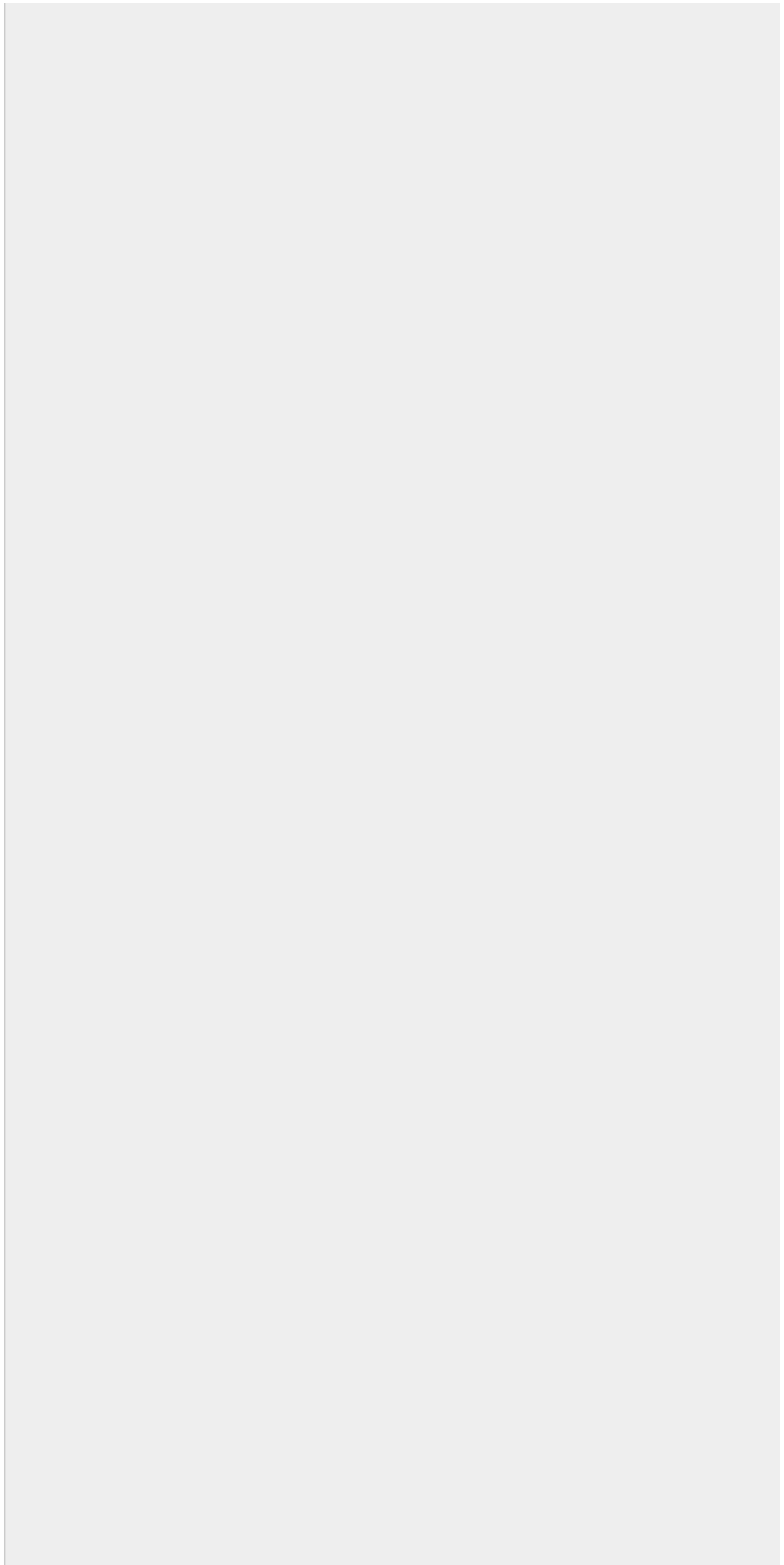
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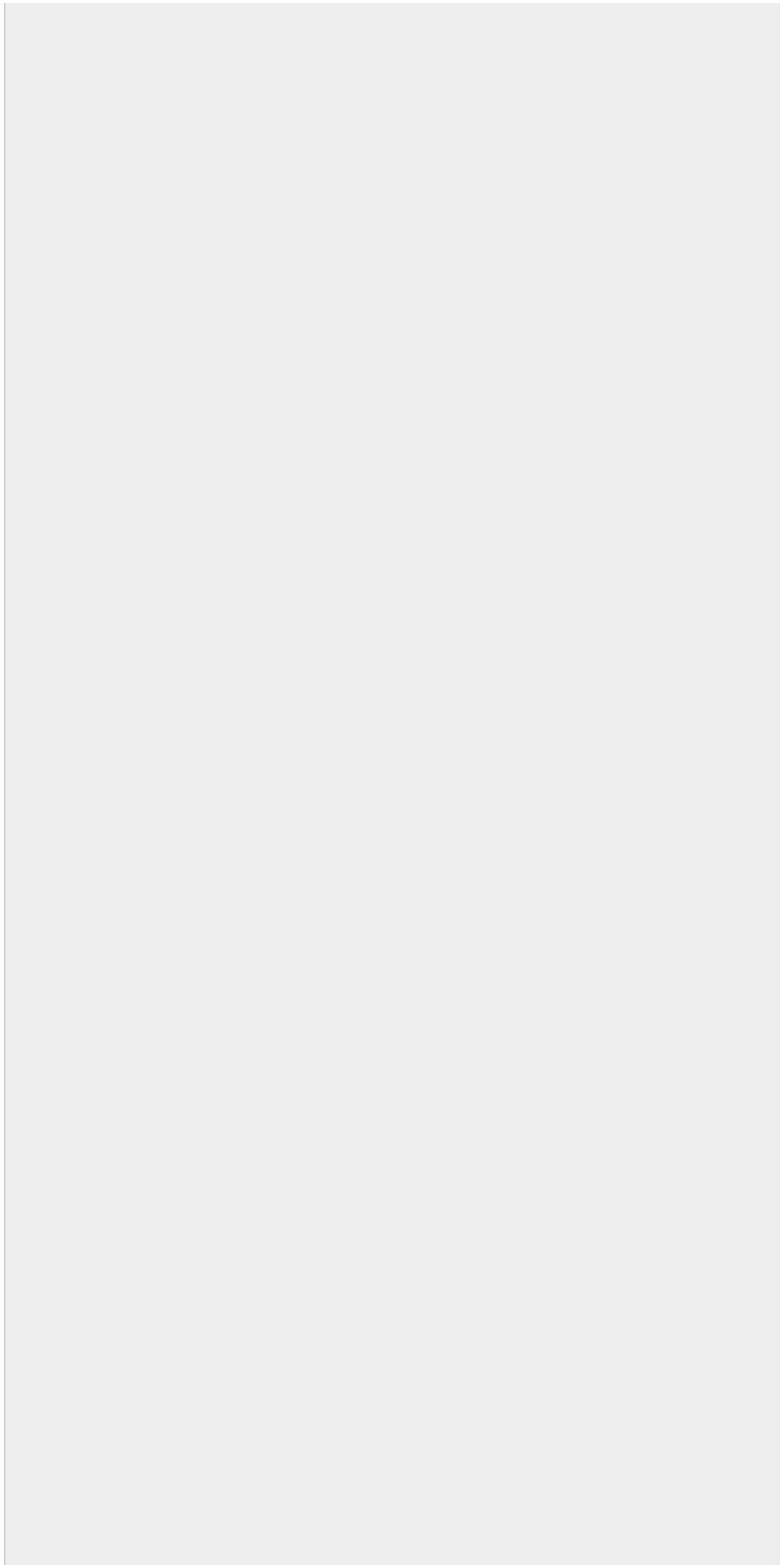
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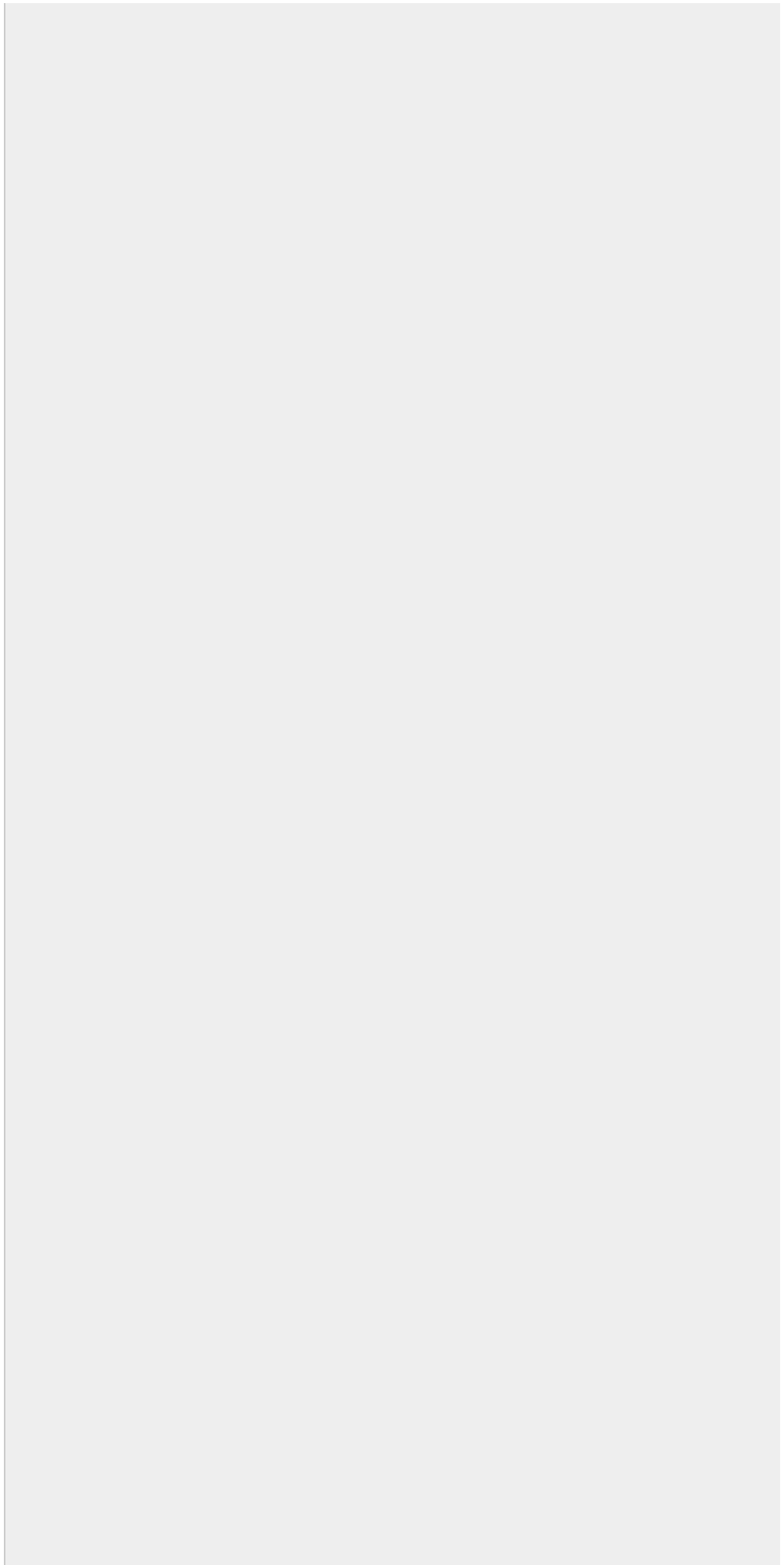
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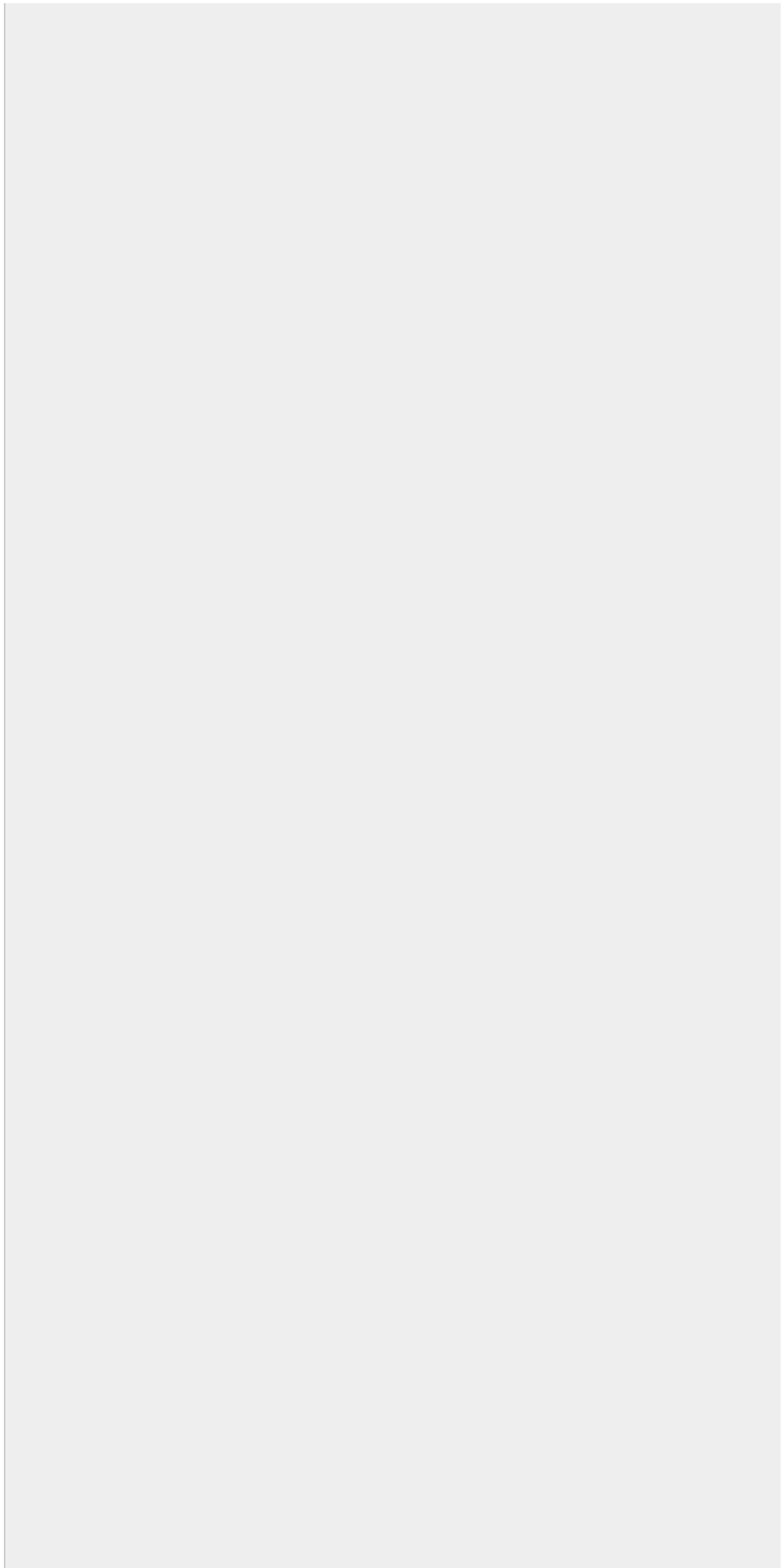


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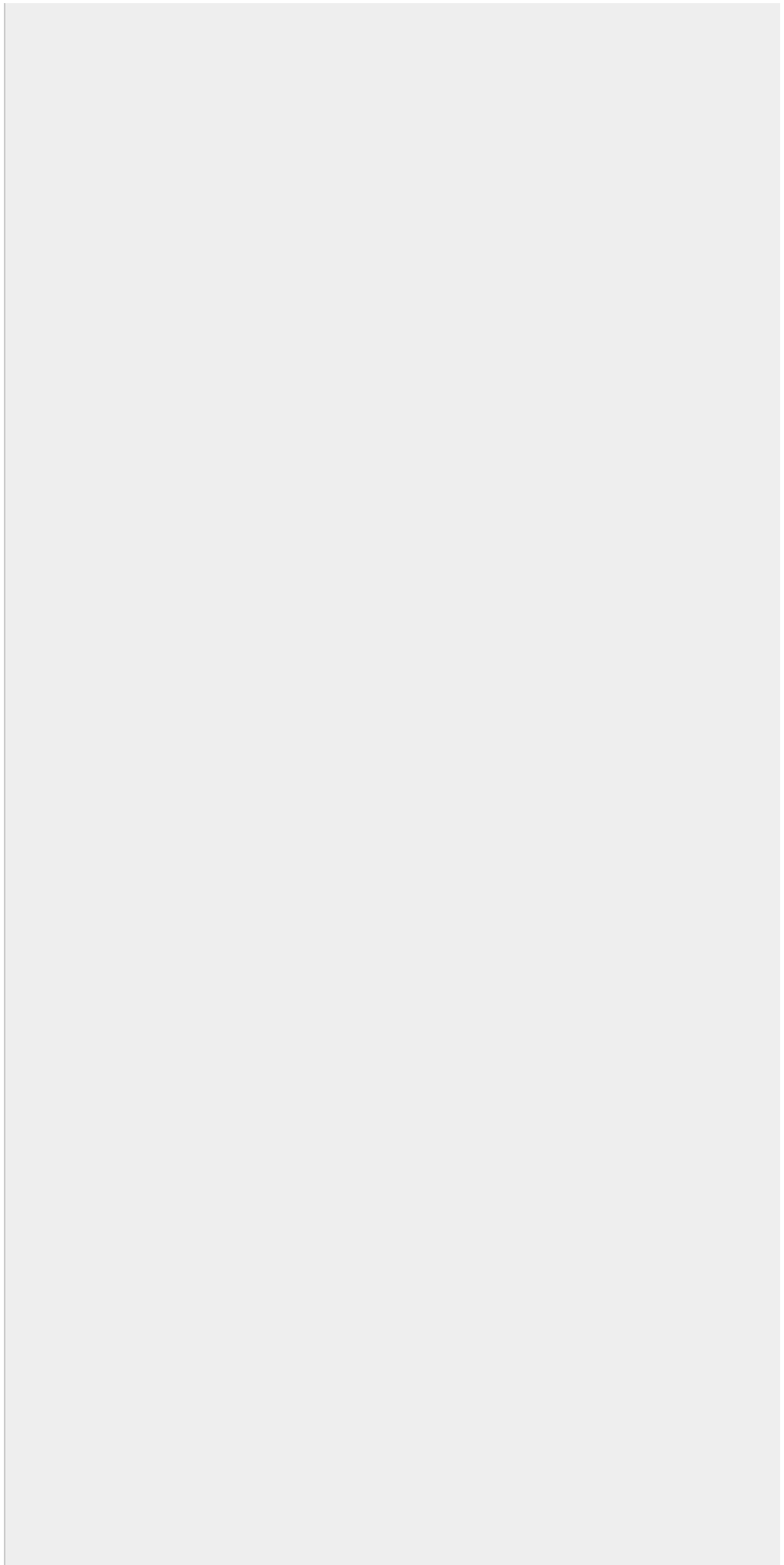




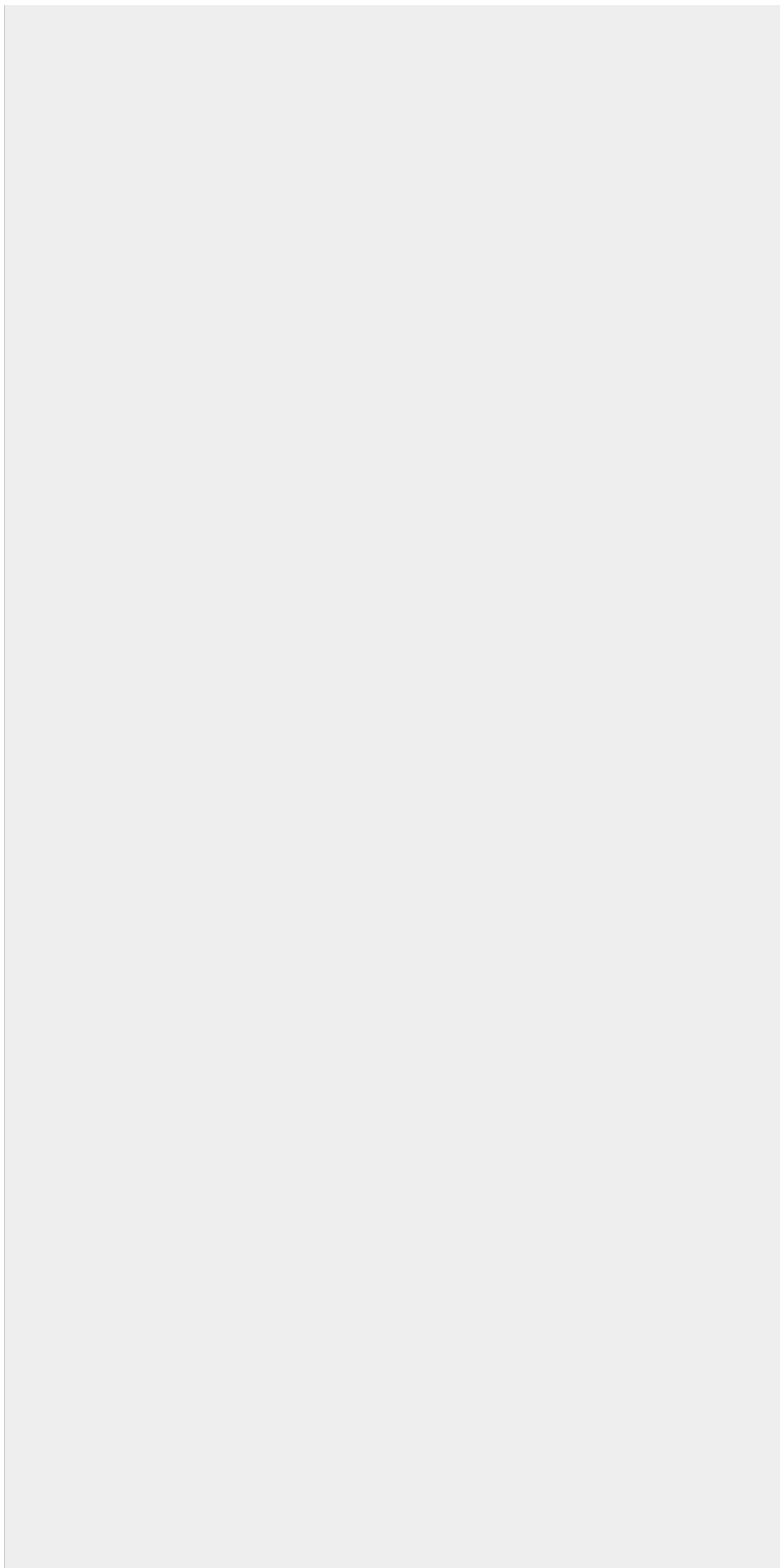
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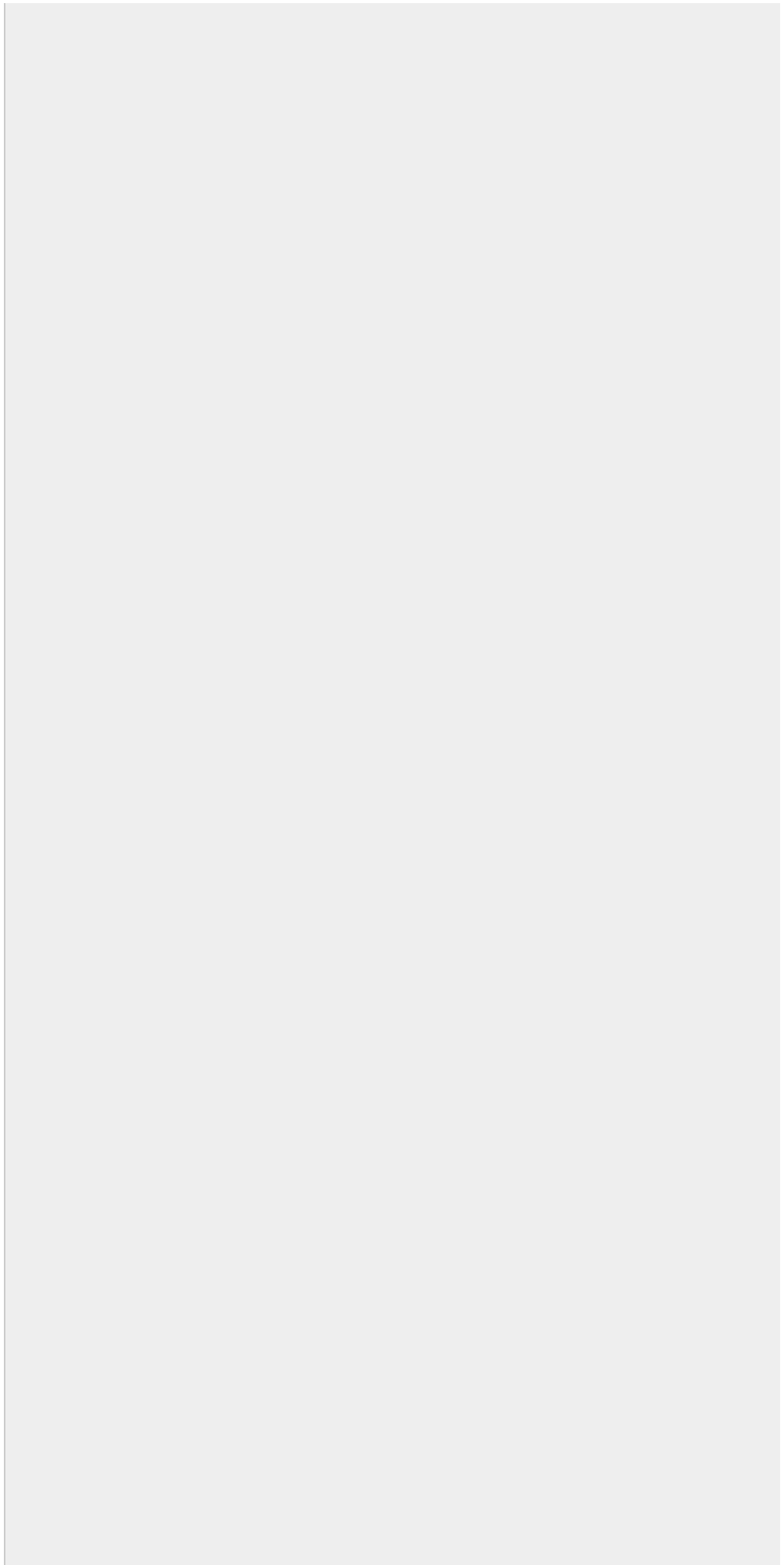
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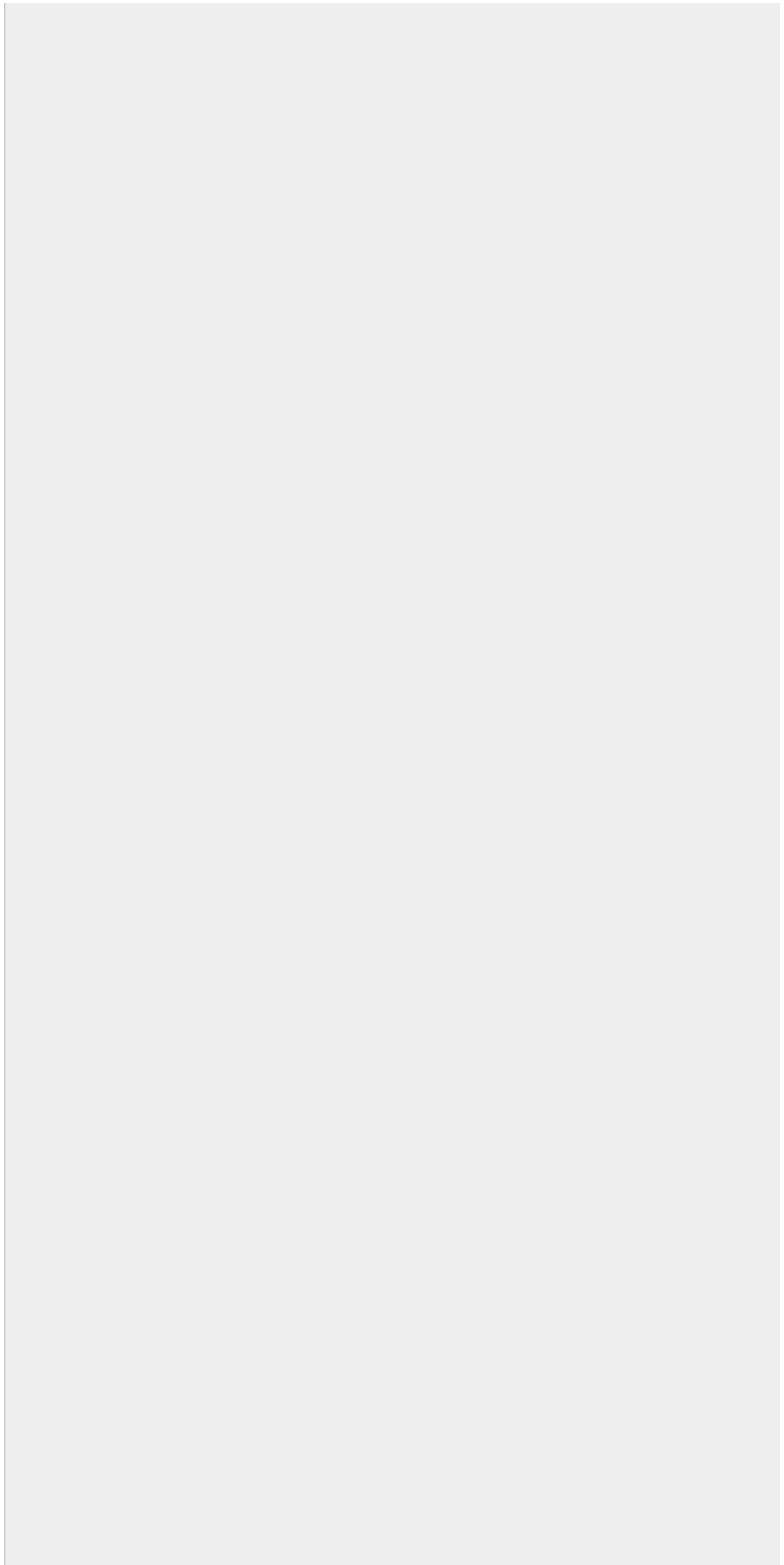
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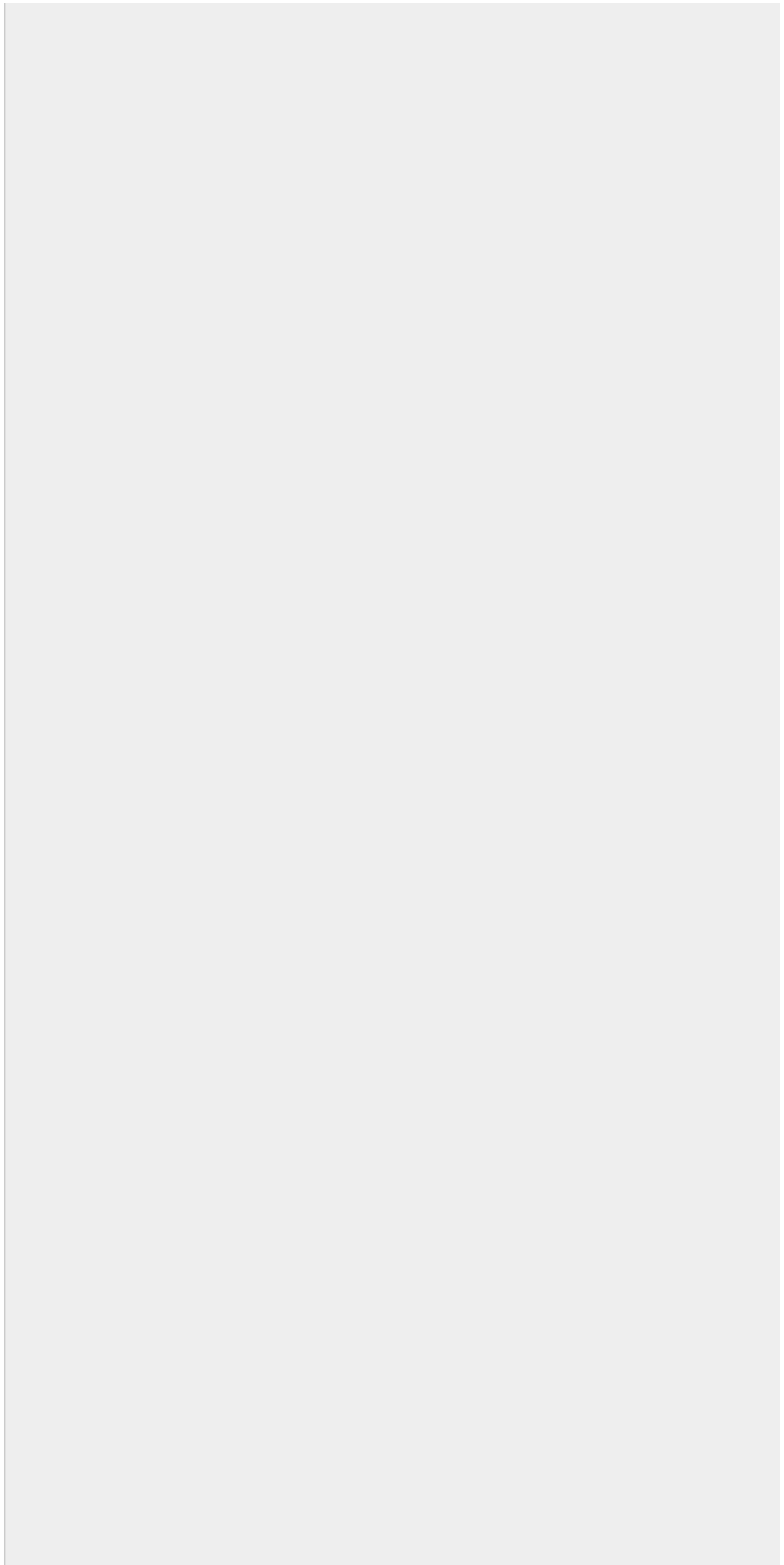
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- 1401 (2011) ✓
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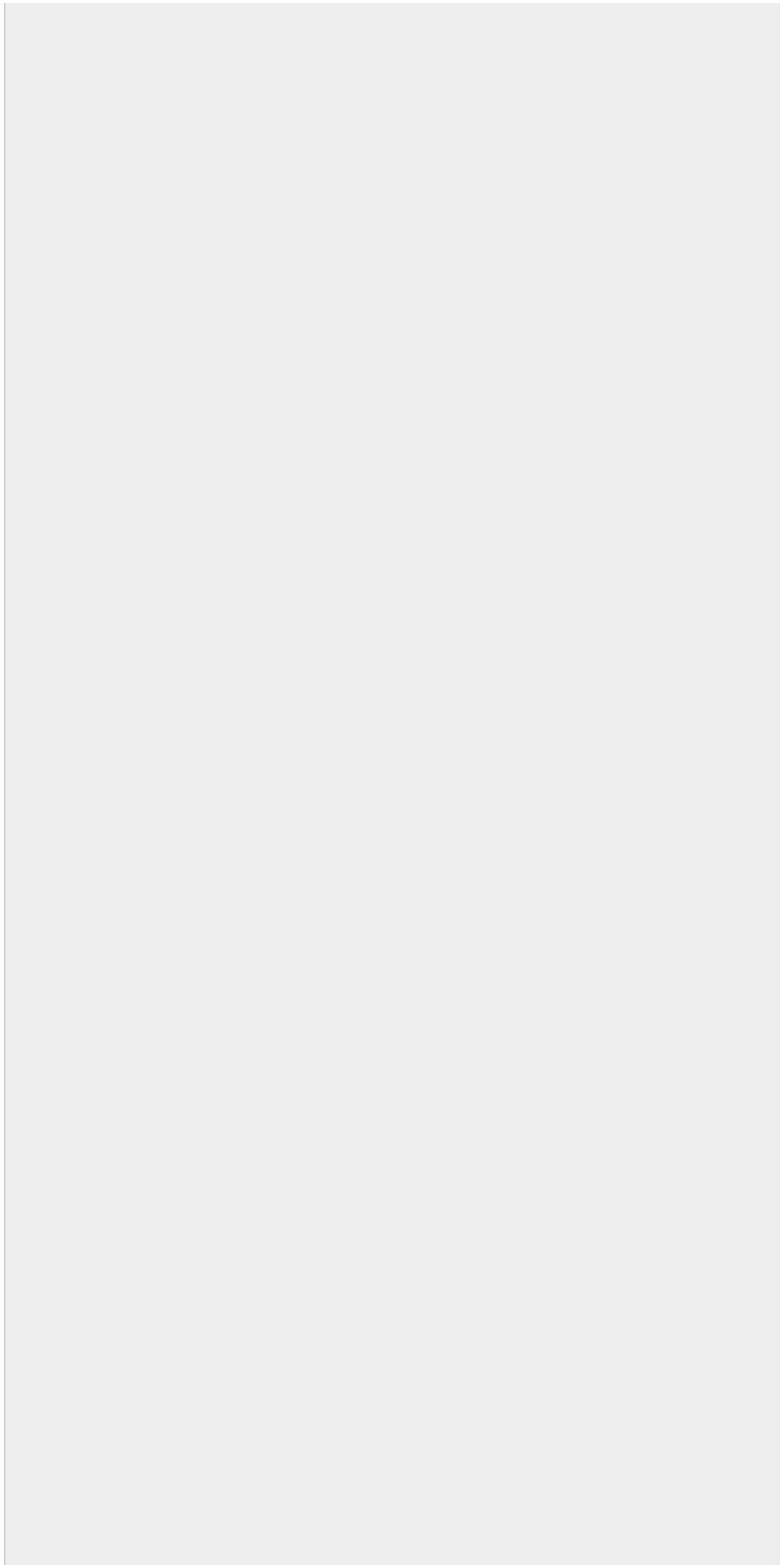
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- 1380 (2011) ✓
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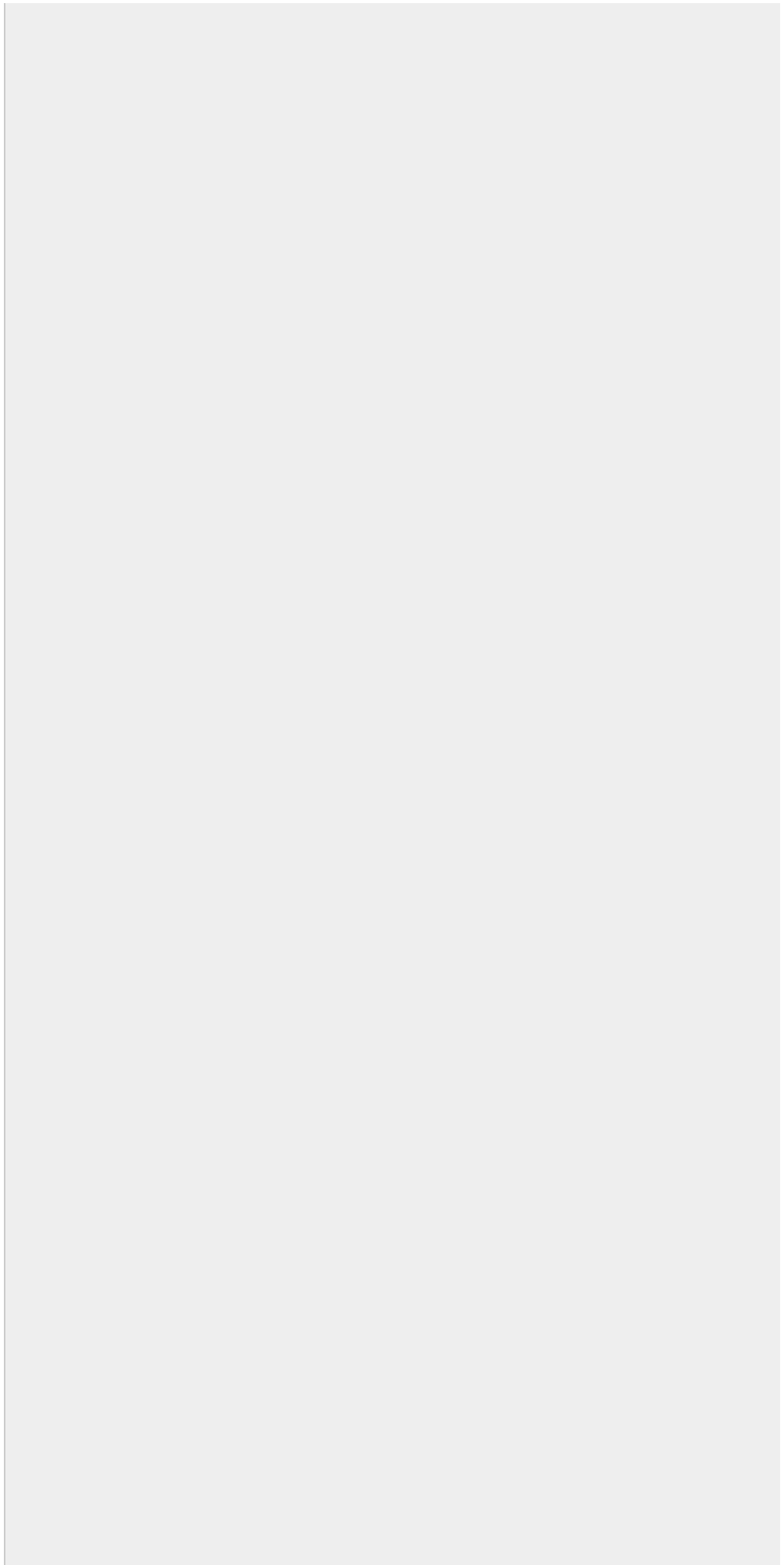
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- 1371 (2011) ✓
- 1326 (2011) ✓
- 1336 (2011) ✓
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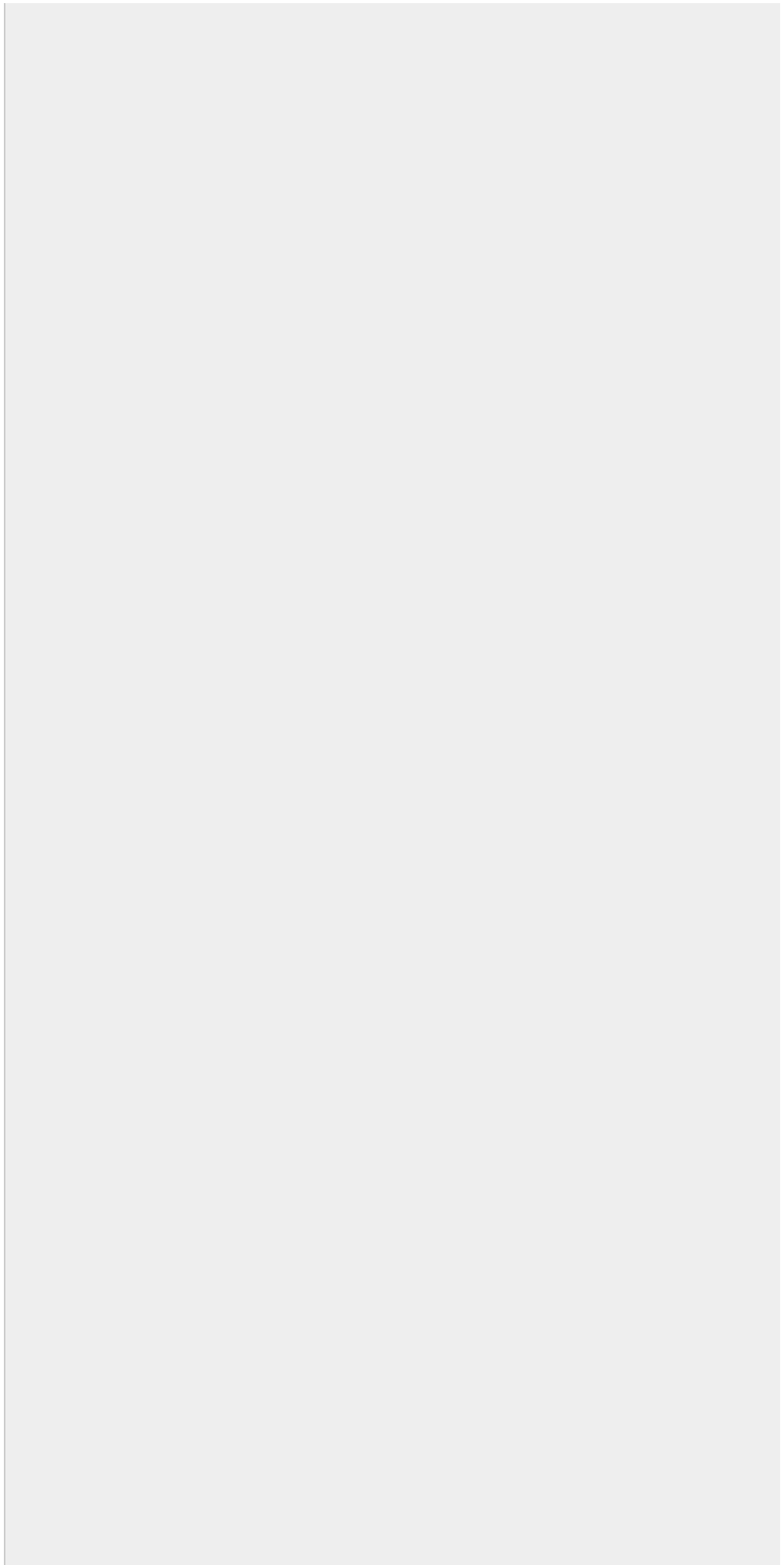


- 1327 (2011) ✓
- 1332 (2011) ✓
- 1334 (2011) ✓
- 1305 (2011) ✓
- 1331 (2011) ✓
- 1329 (2011) ✓
- 1315 (2011) ✓
- 1321 (2011) ✓
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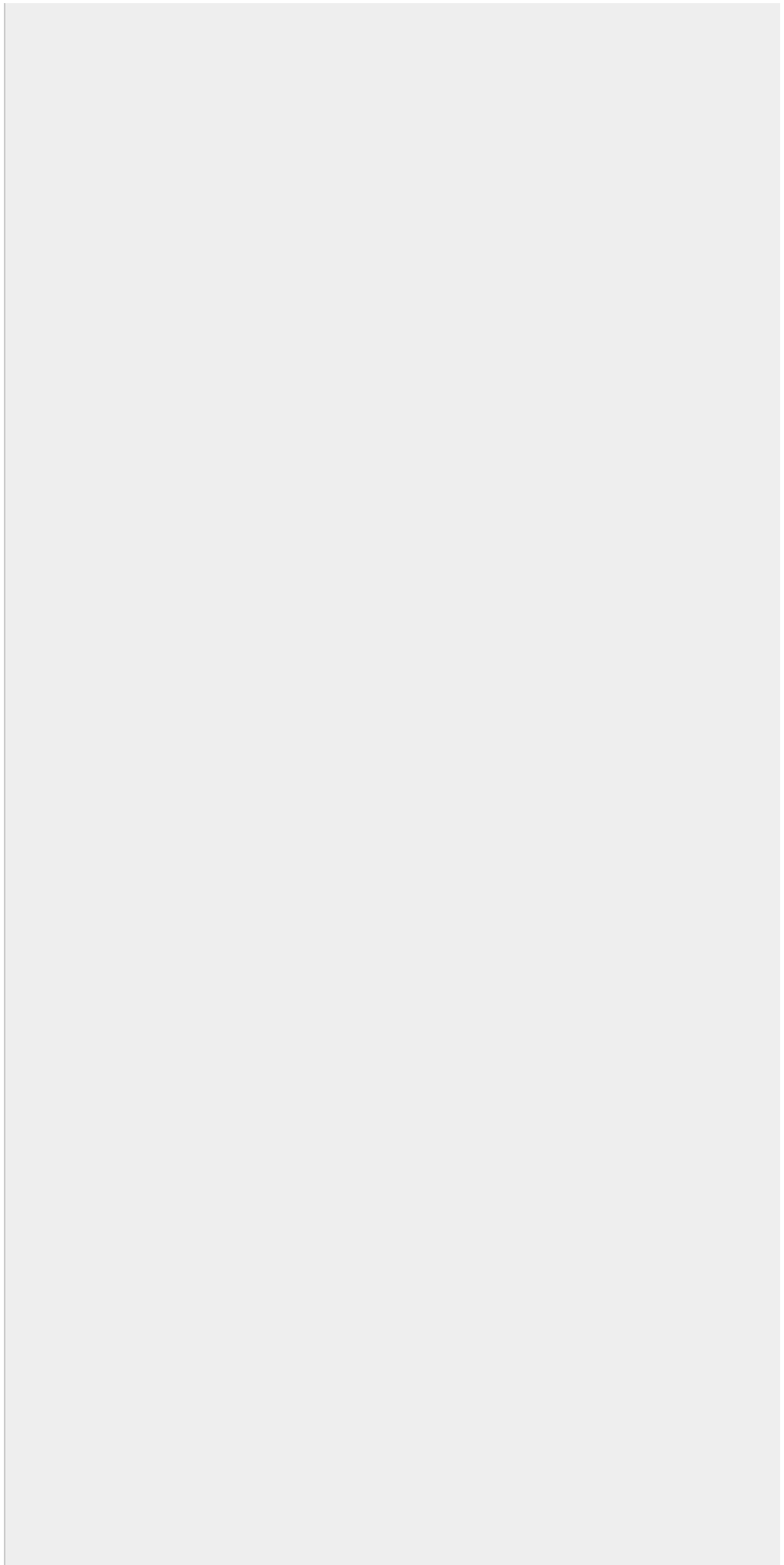




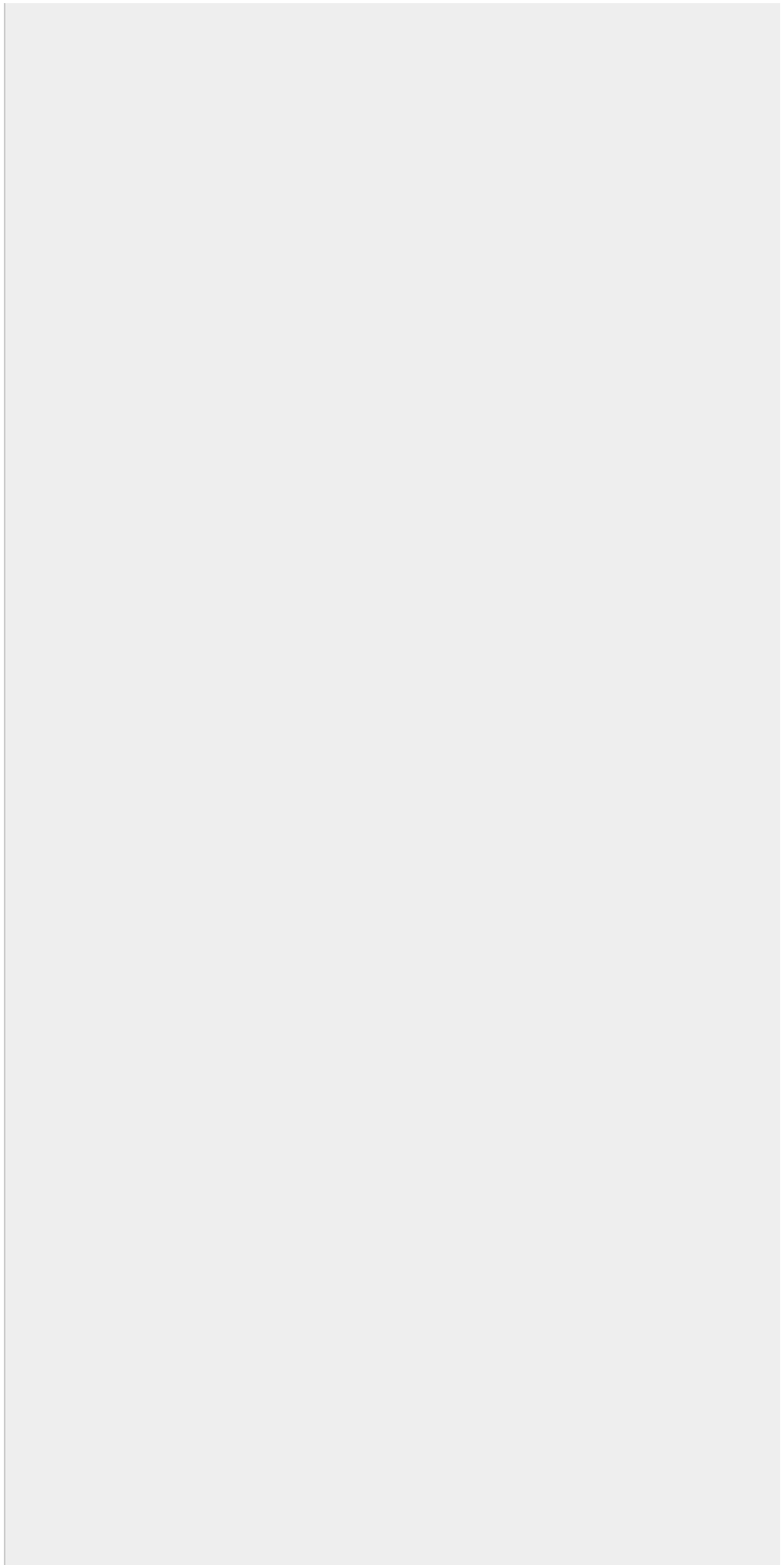
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- 1303 (2010) ✓
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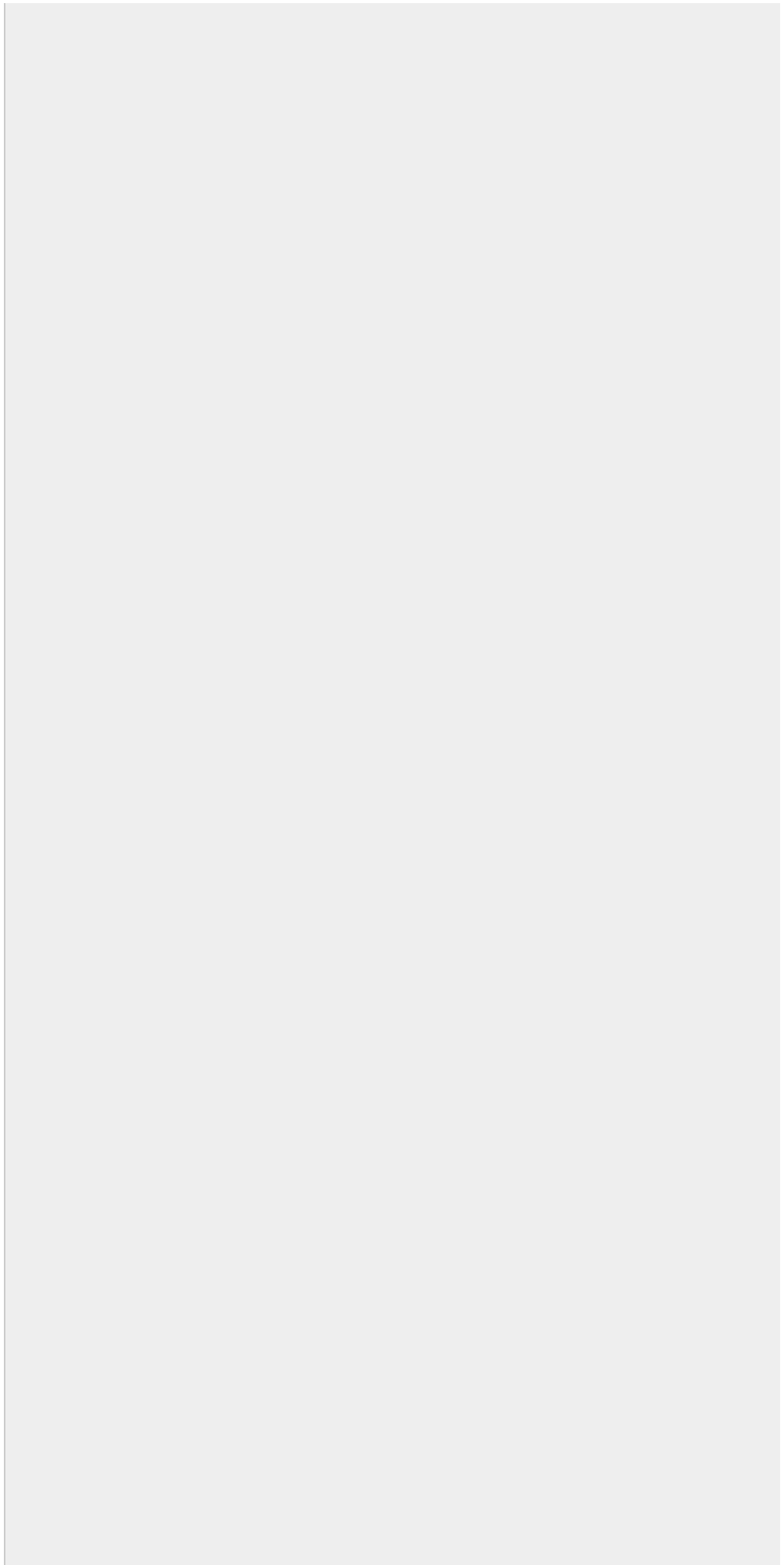
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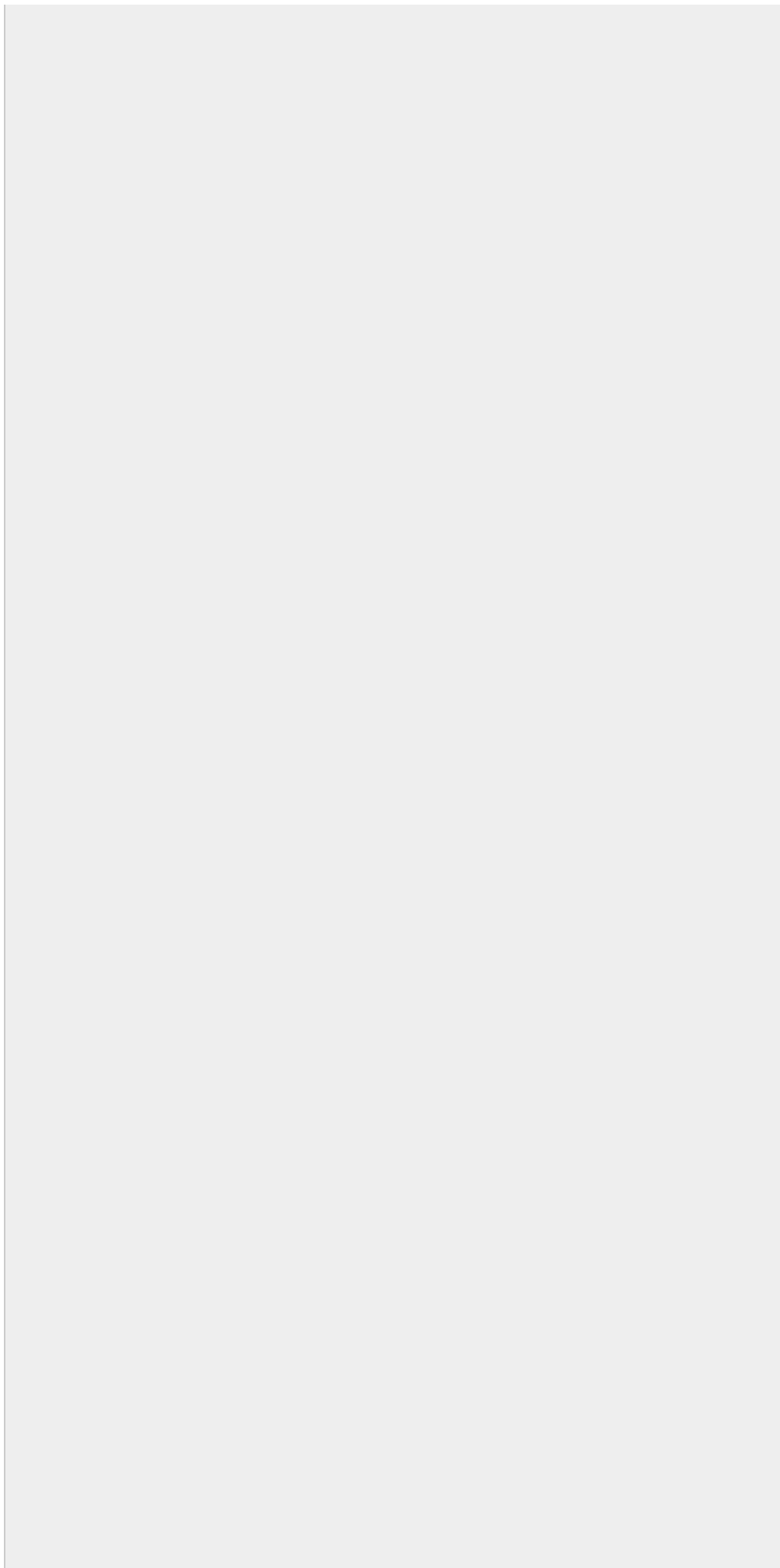
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- 1269 (2010) ✓
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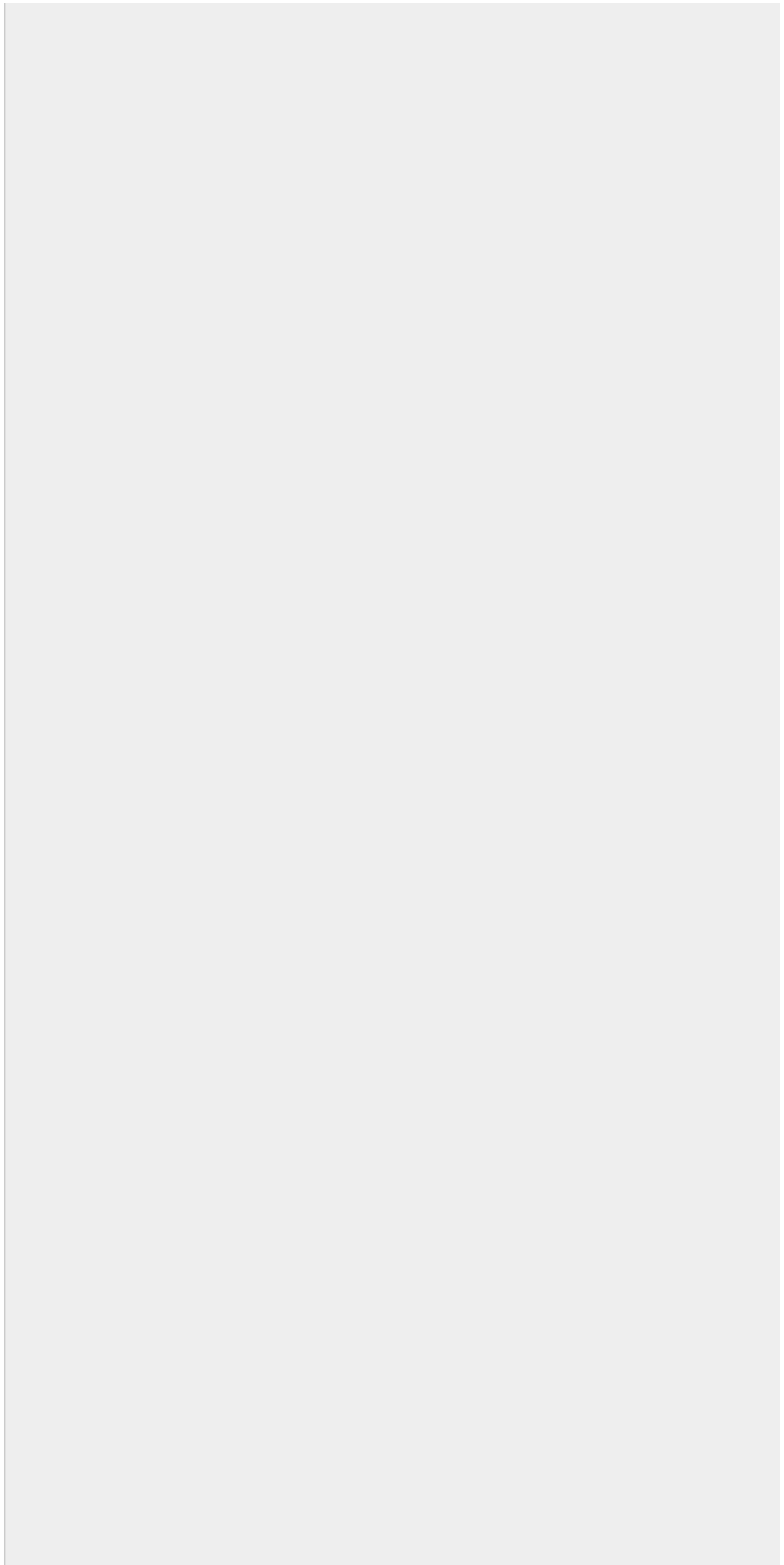
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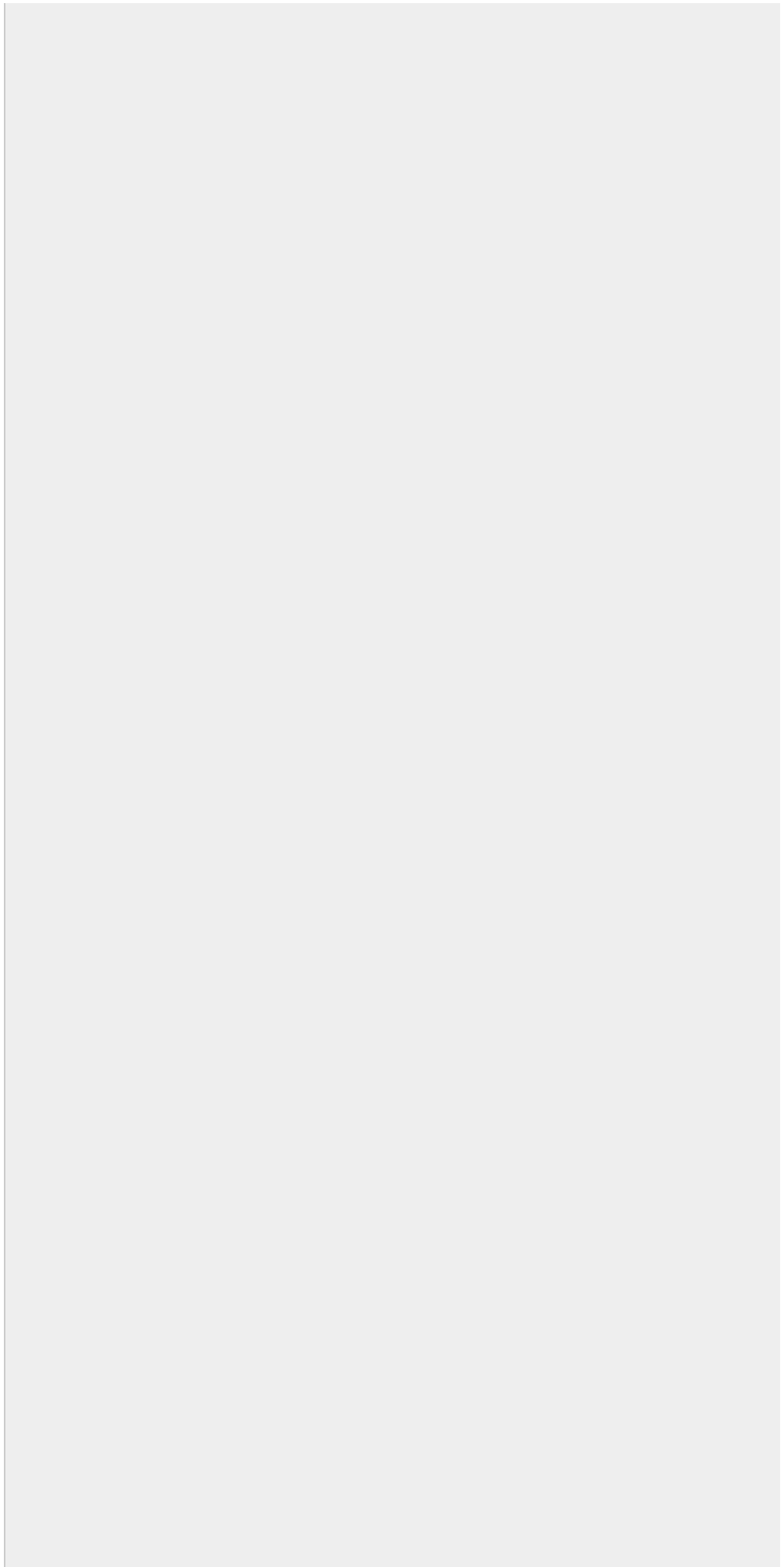
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- 1230 (2010)      ∨
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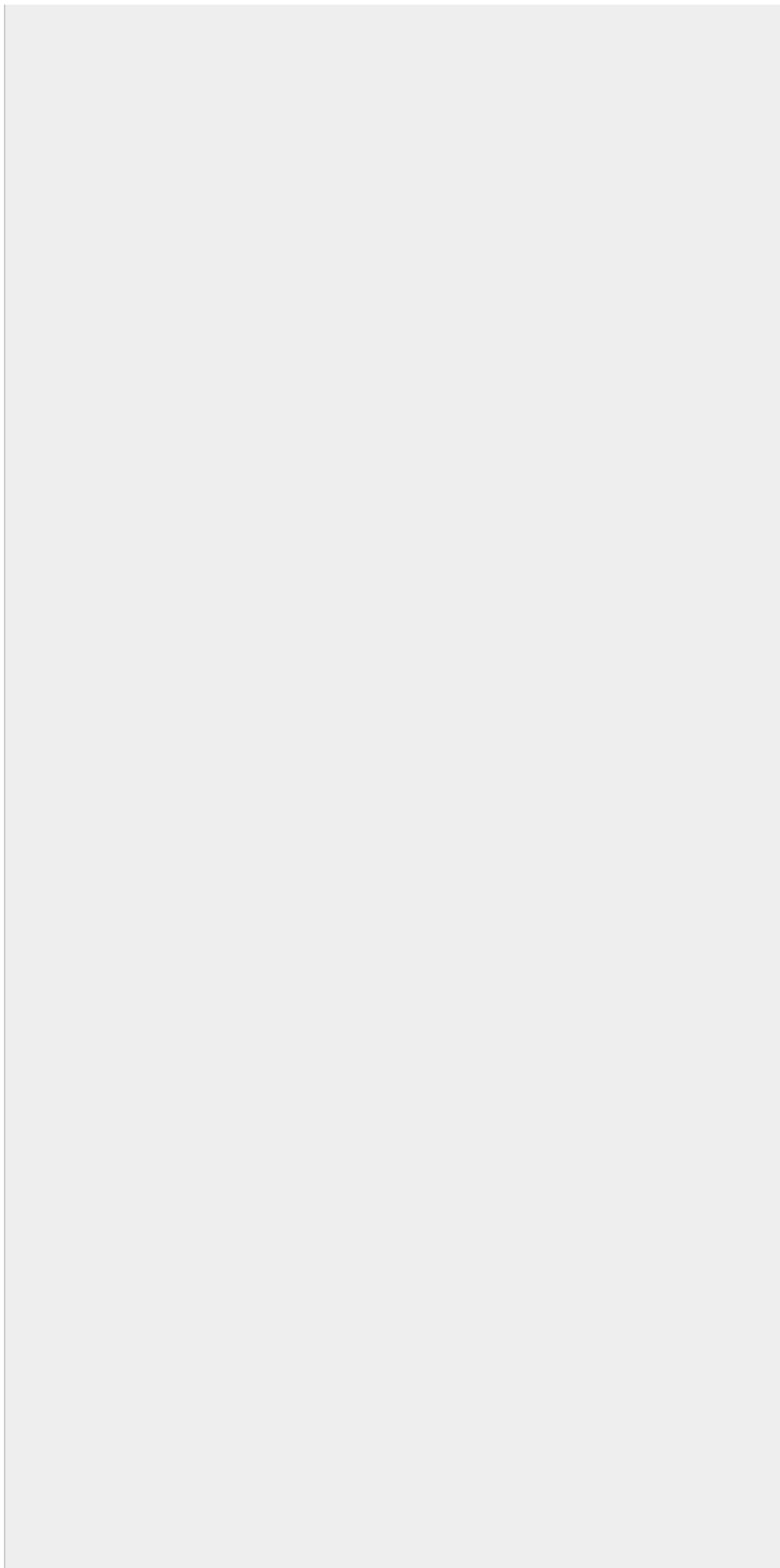
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- 1200 (2010) ✓
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- 1204 (2010)      ∨
- 1202 (2010)      ∨
- 1199 (2010)      ∨
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- 1195 (2009)      ∨
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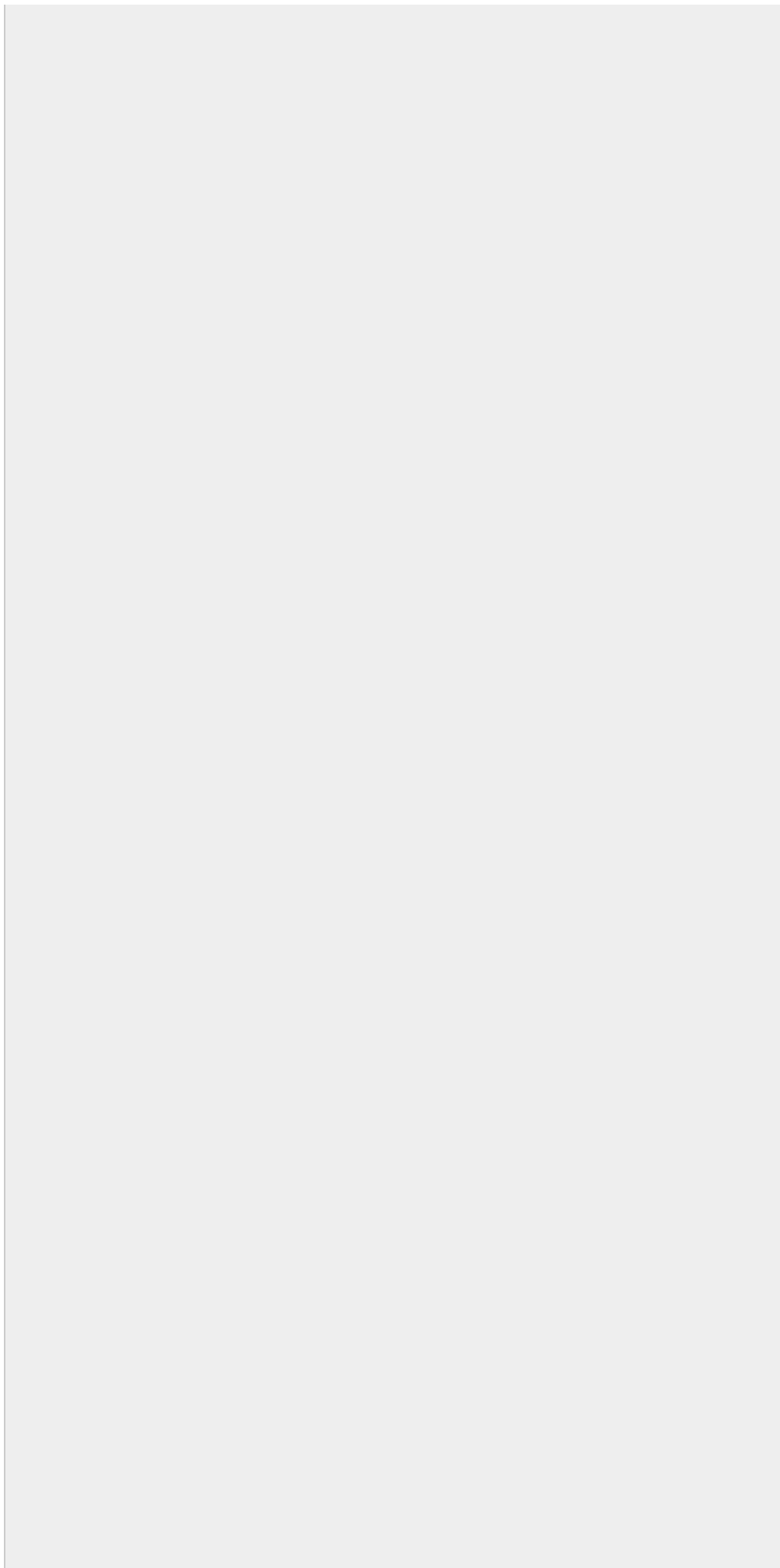


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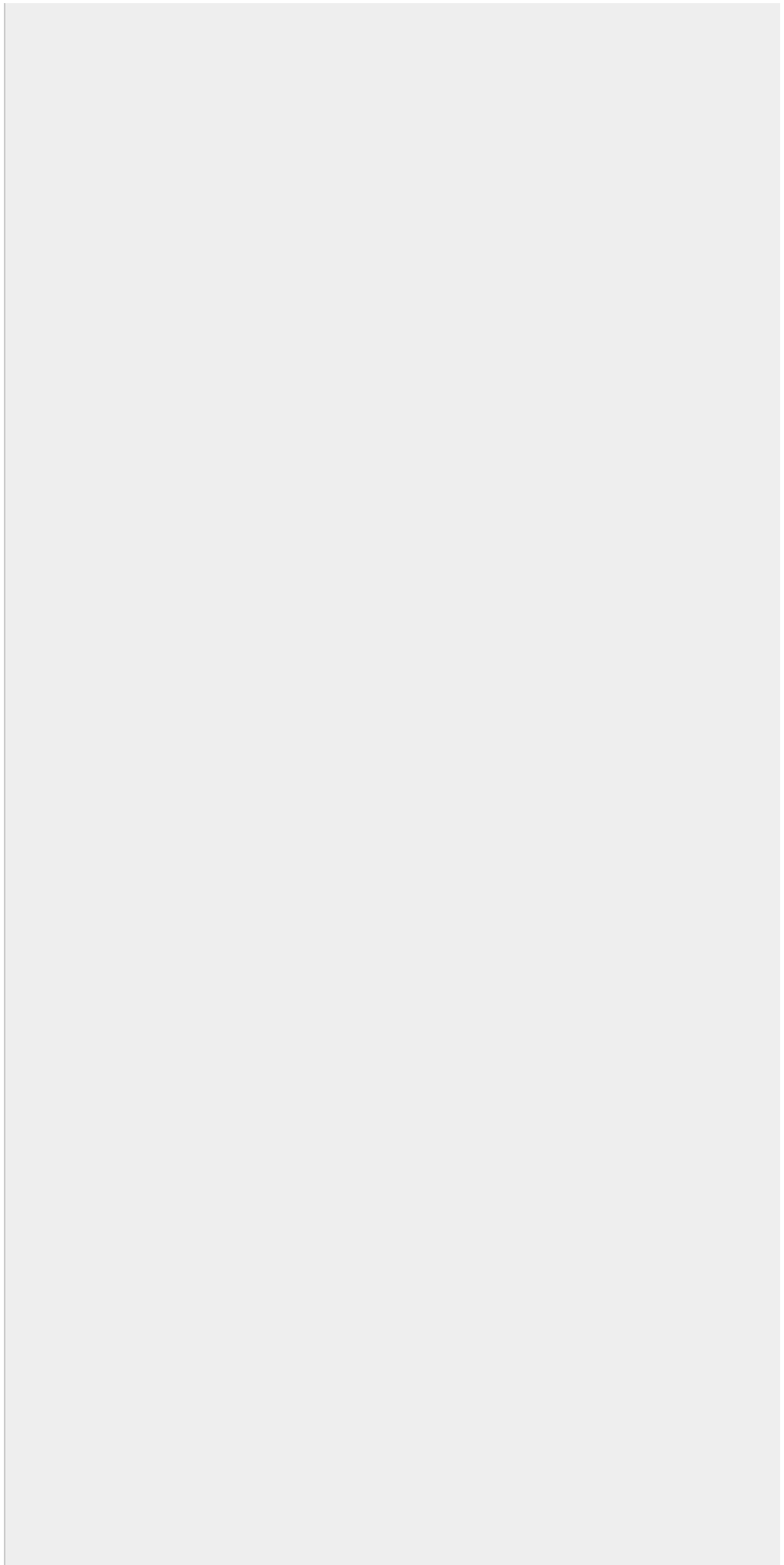




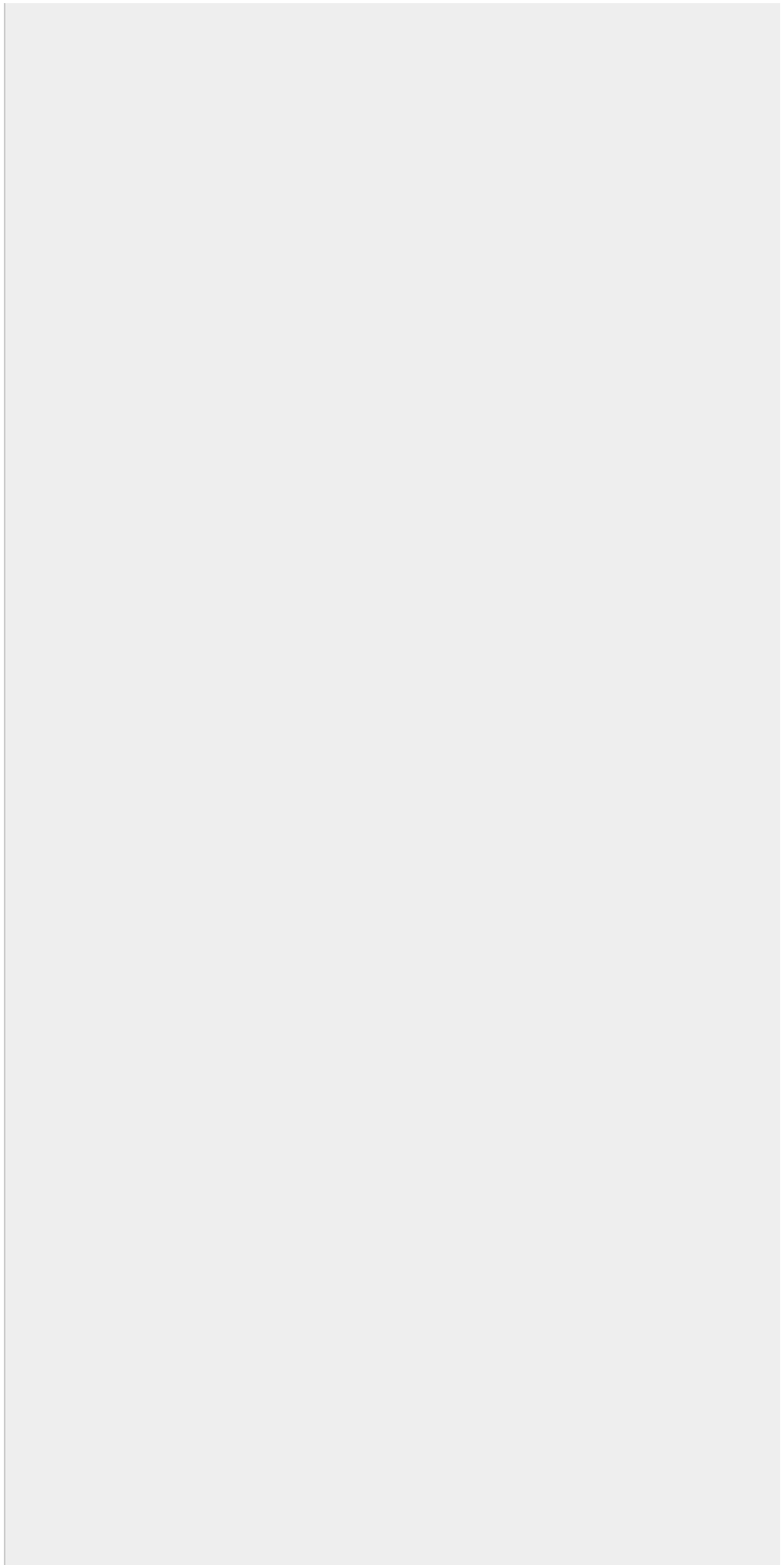
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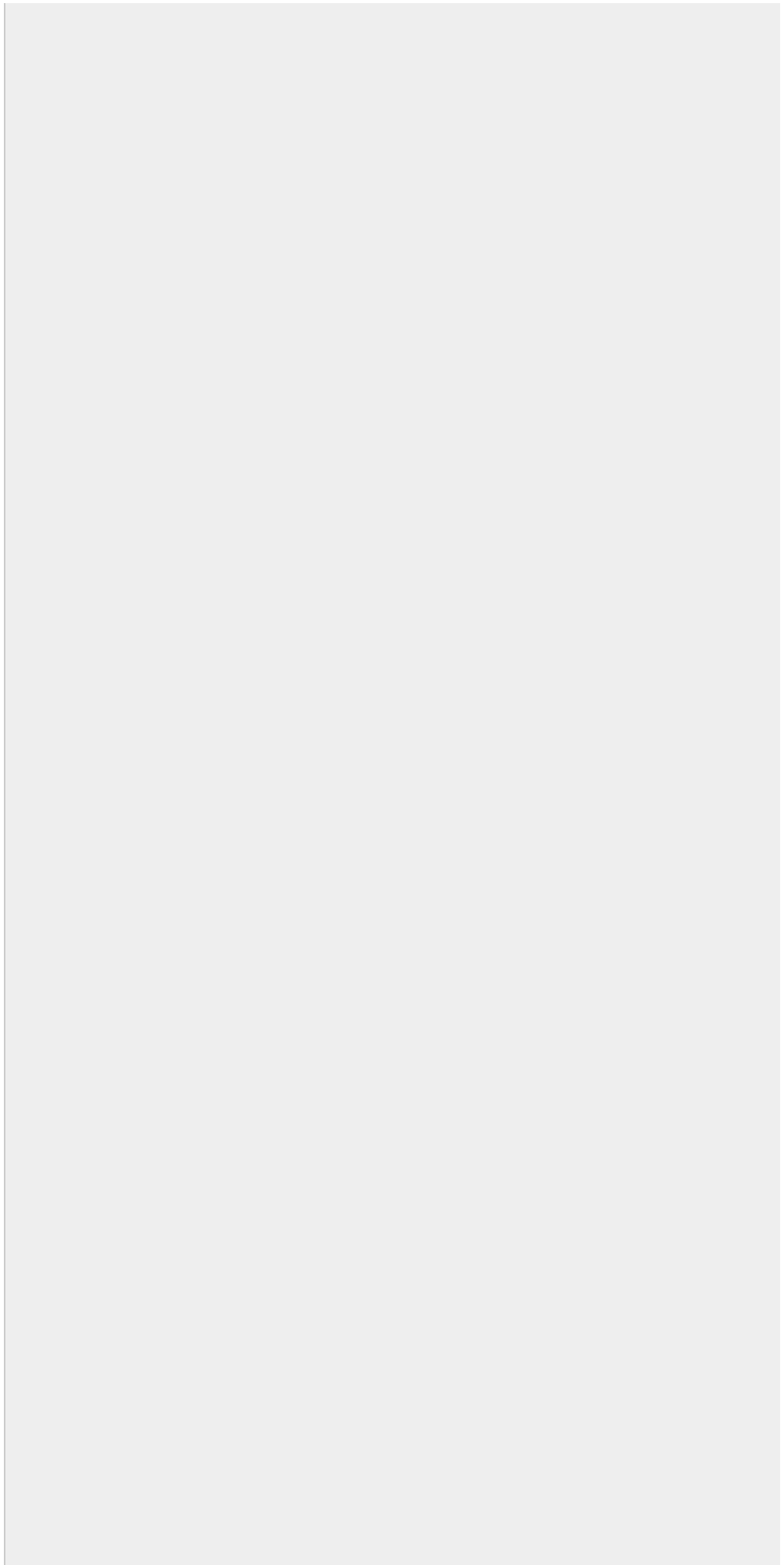
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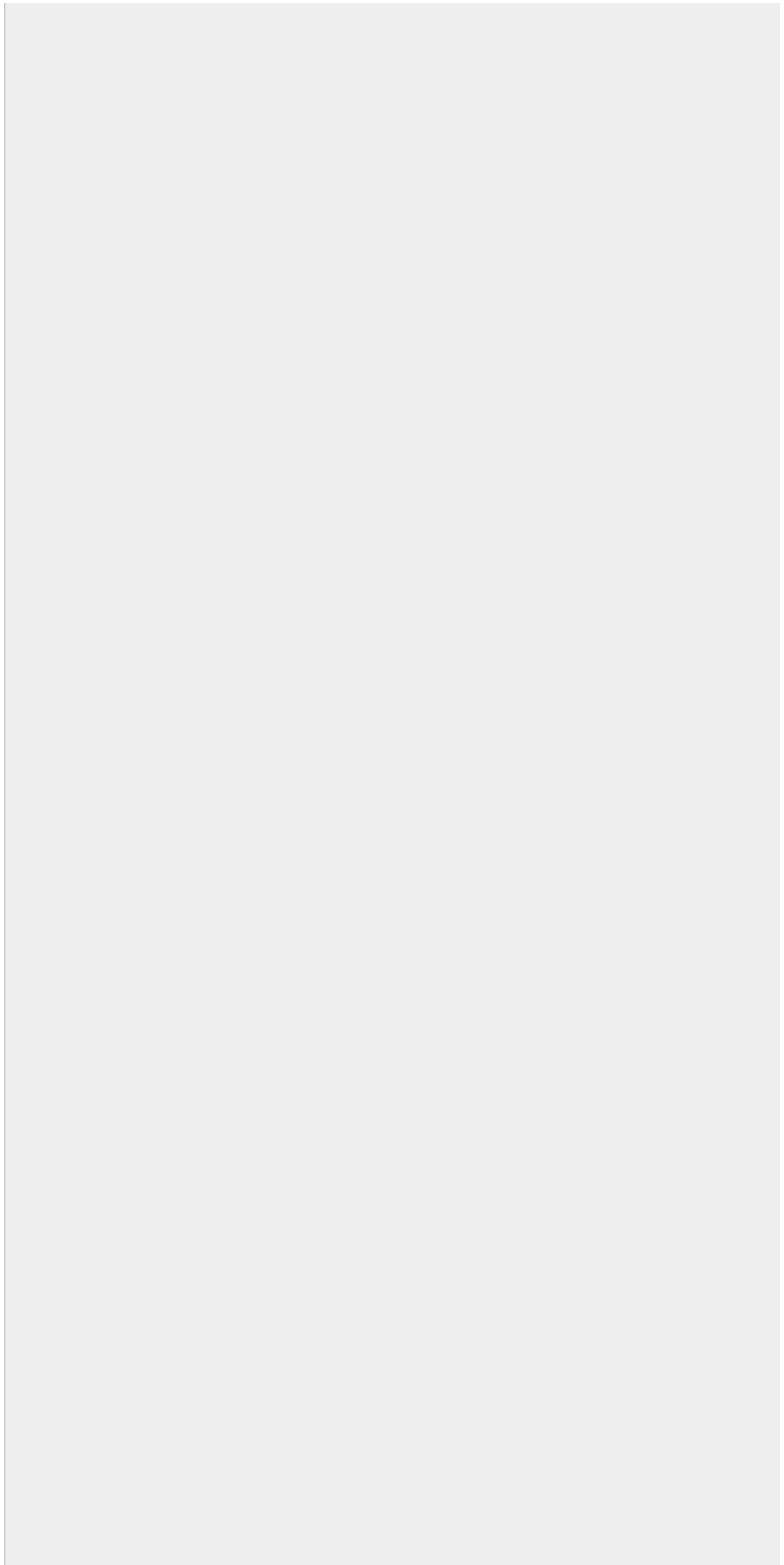
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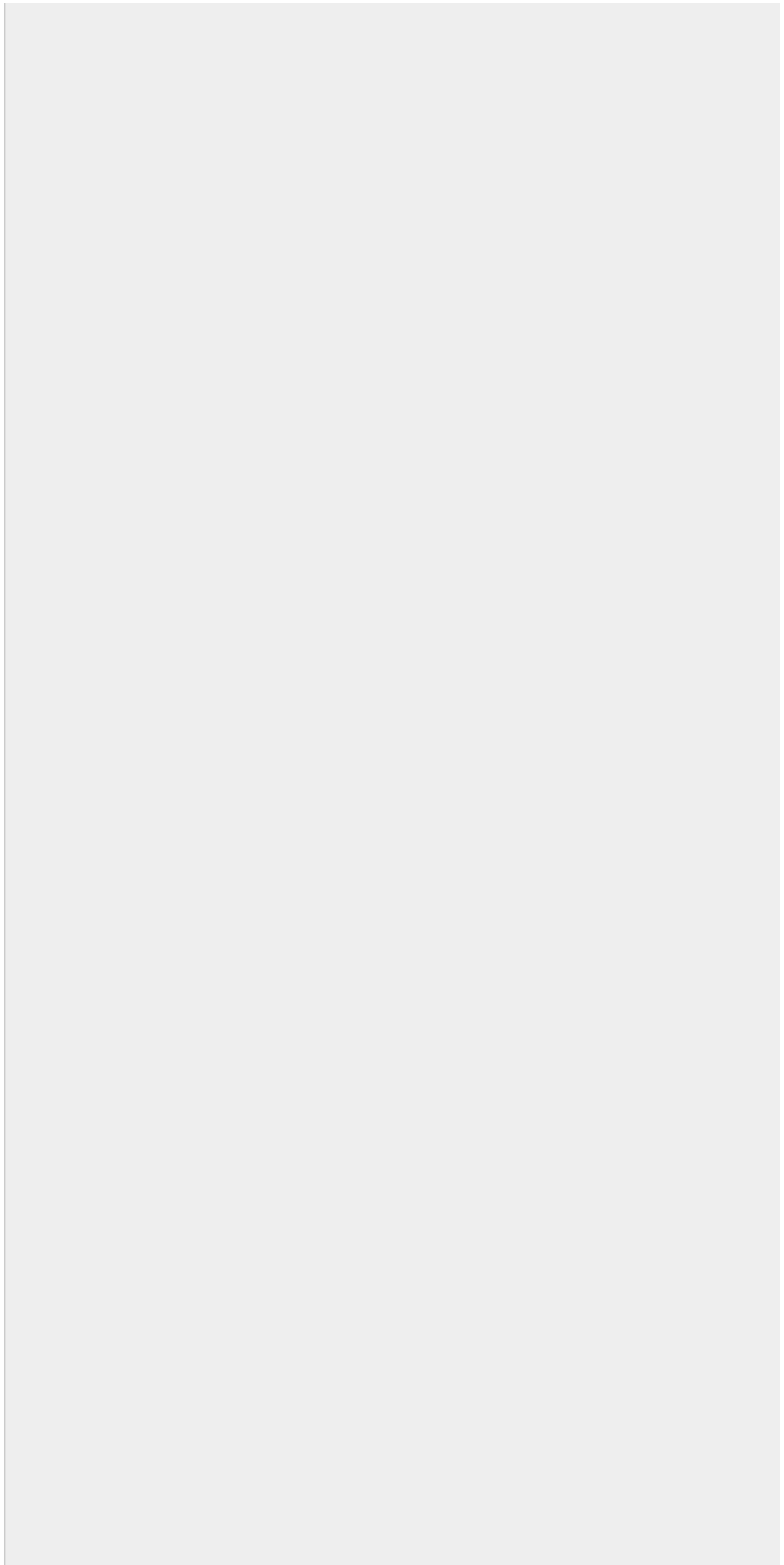
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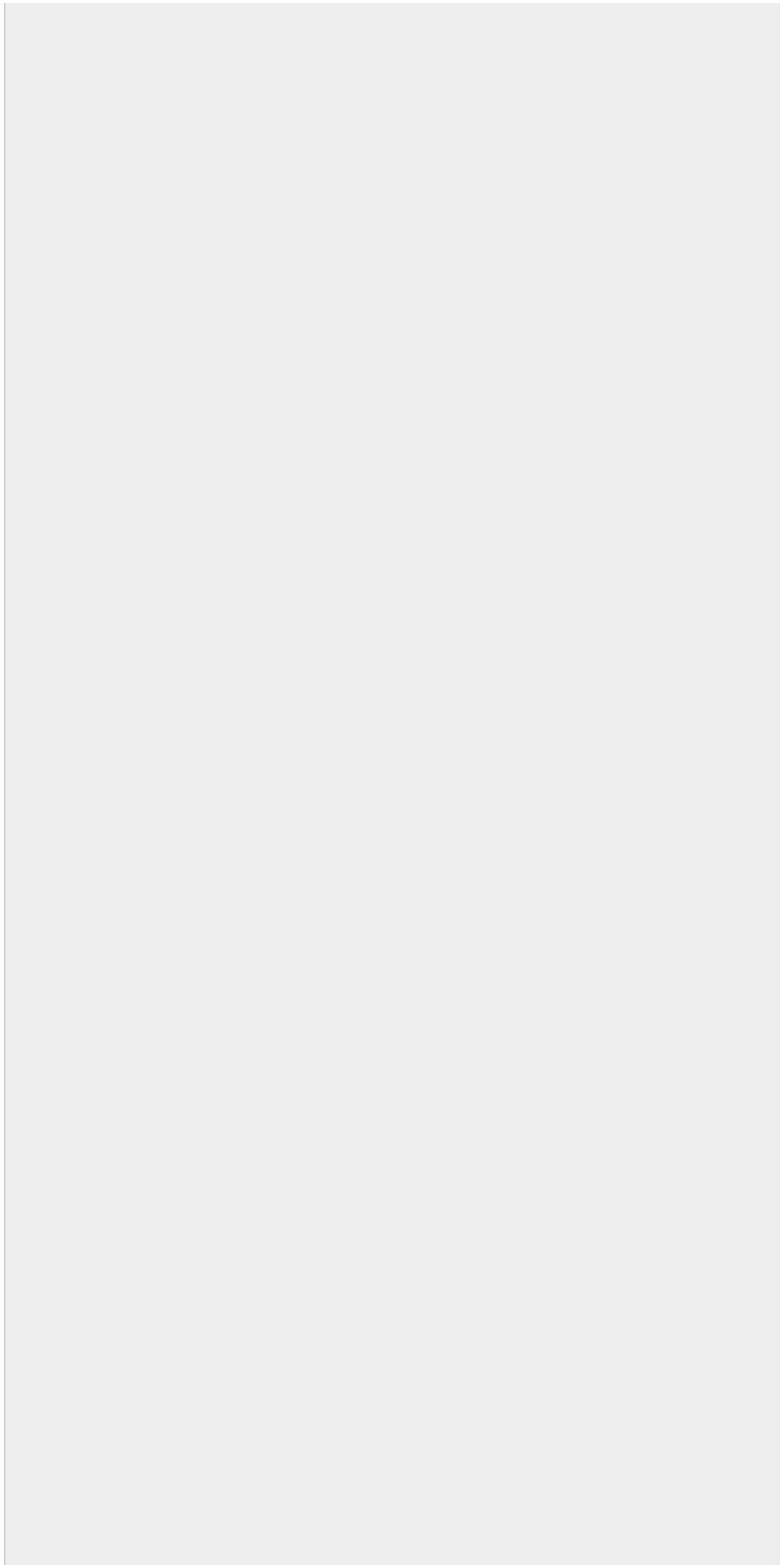
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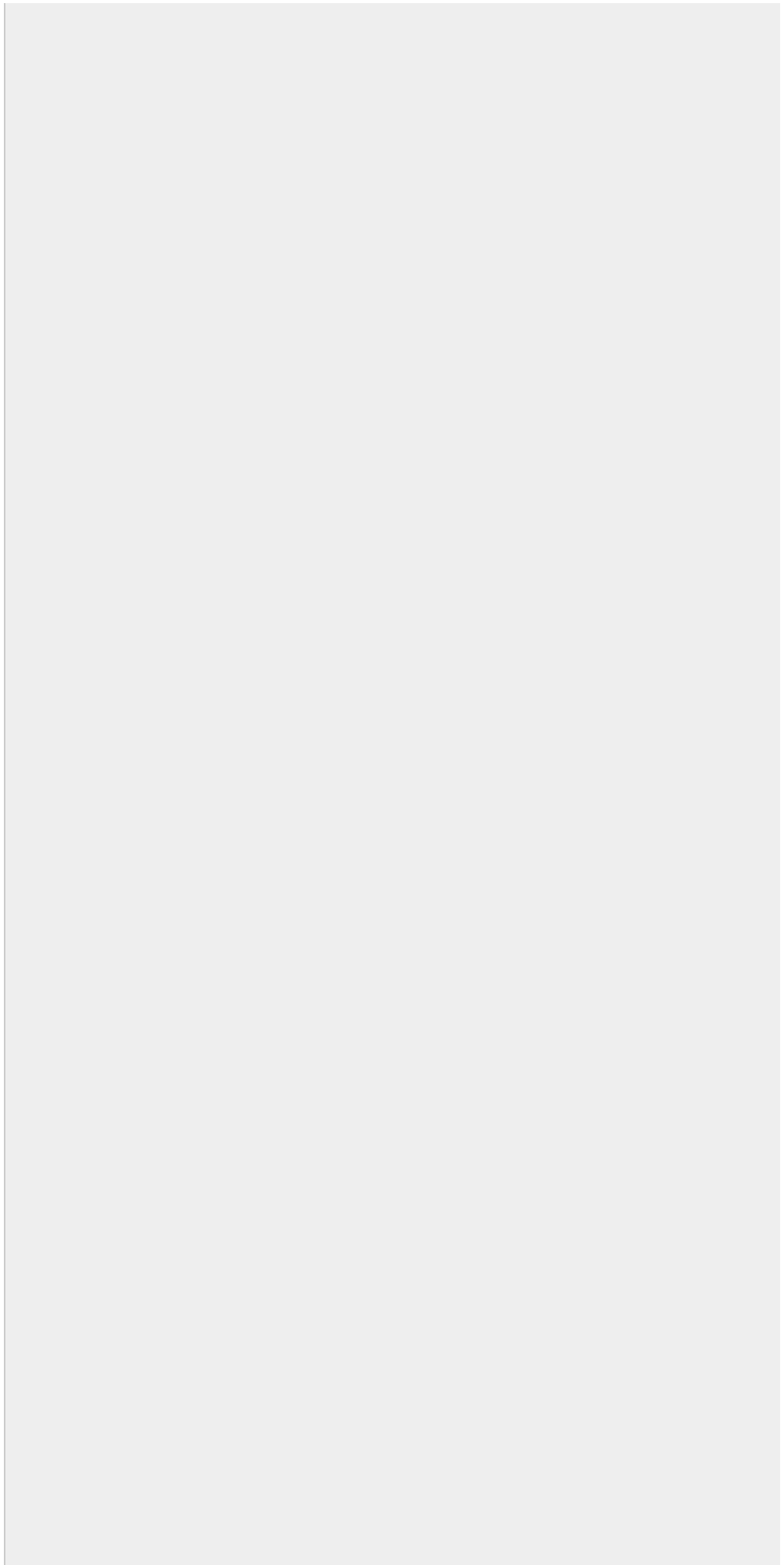
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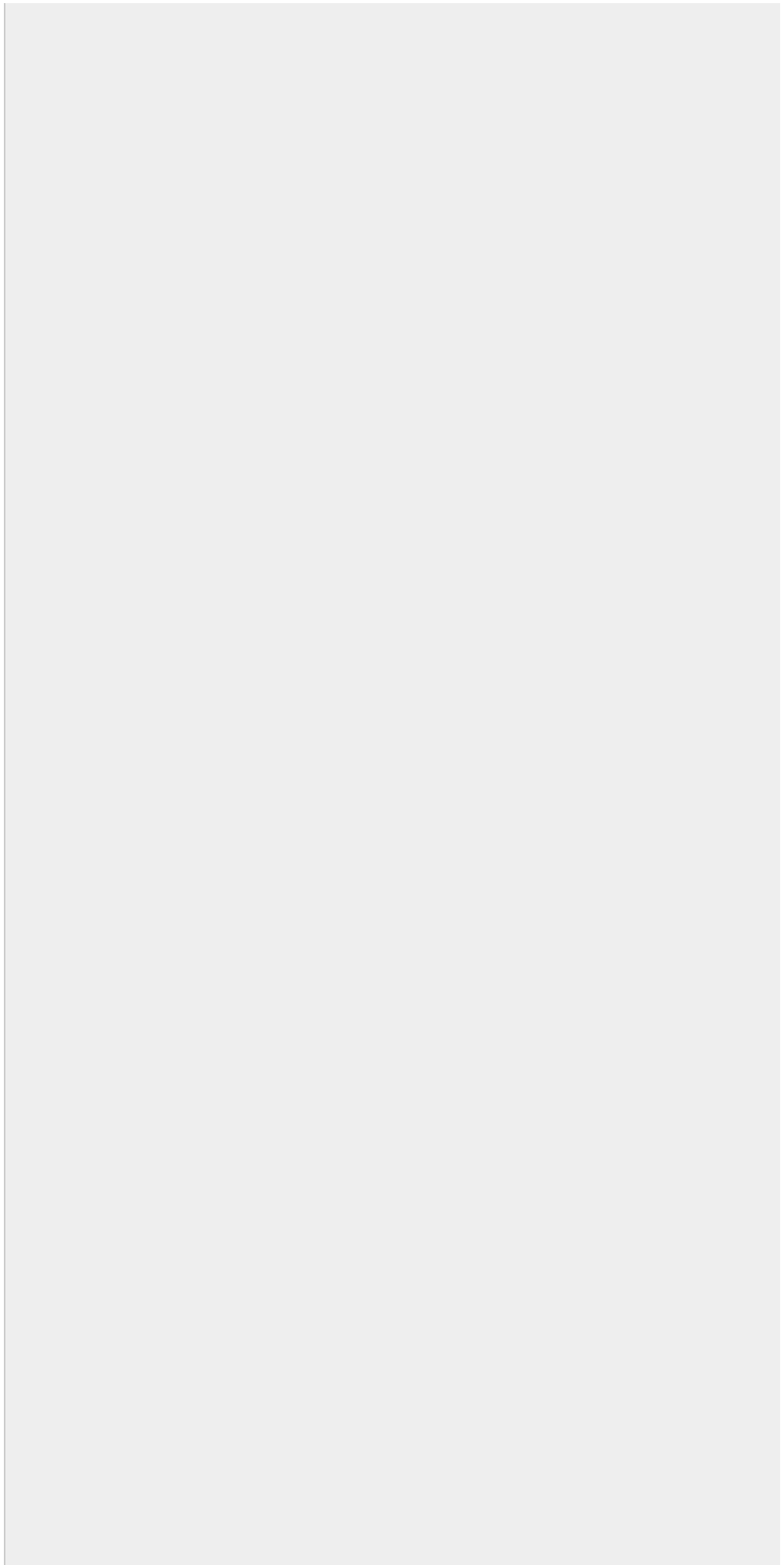


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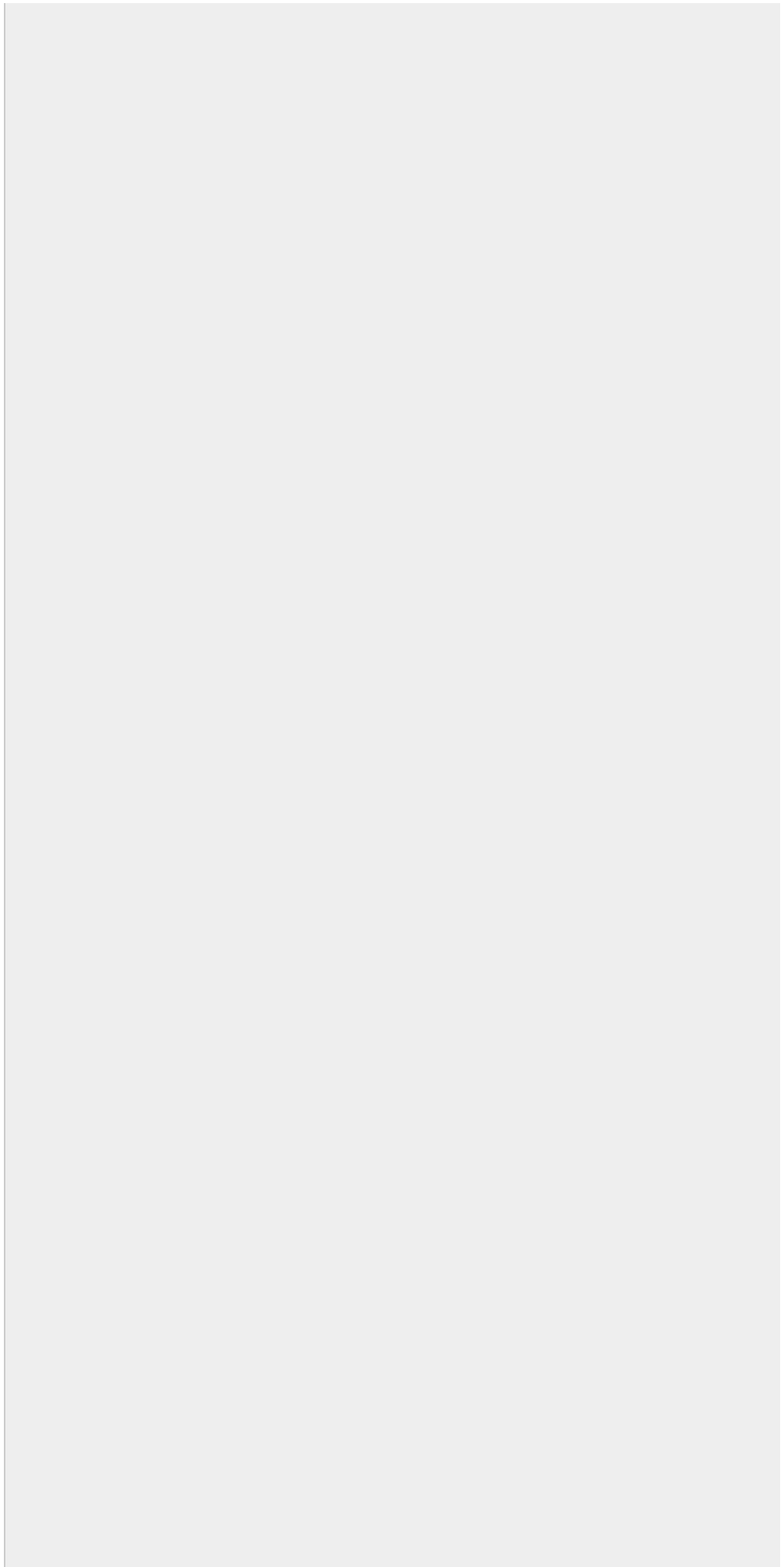




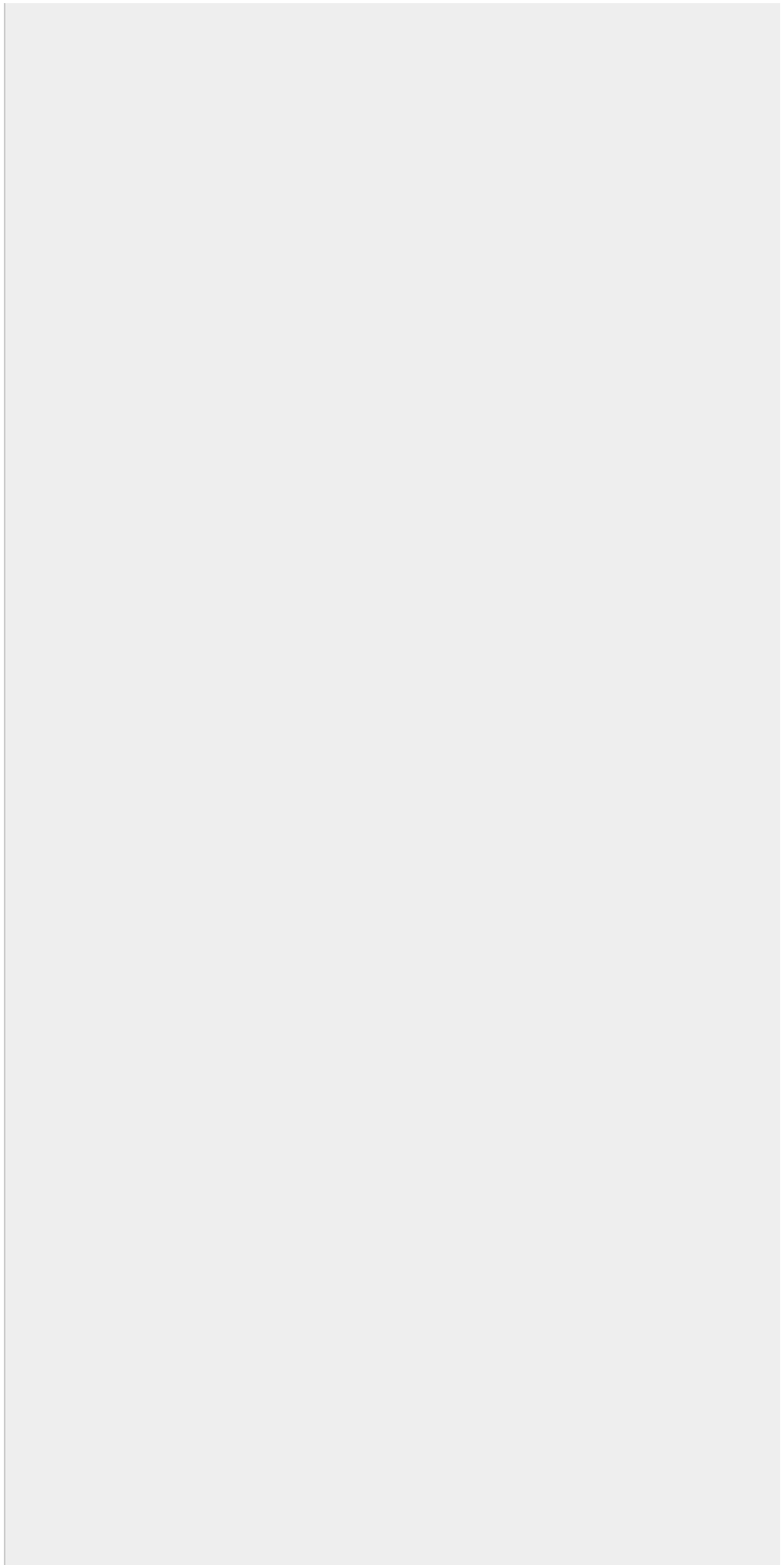
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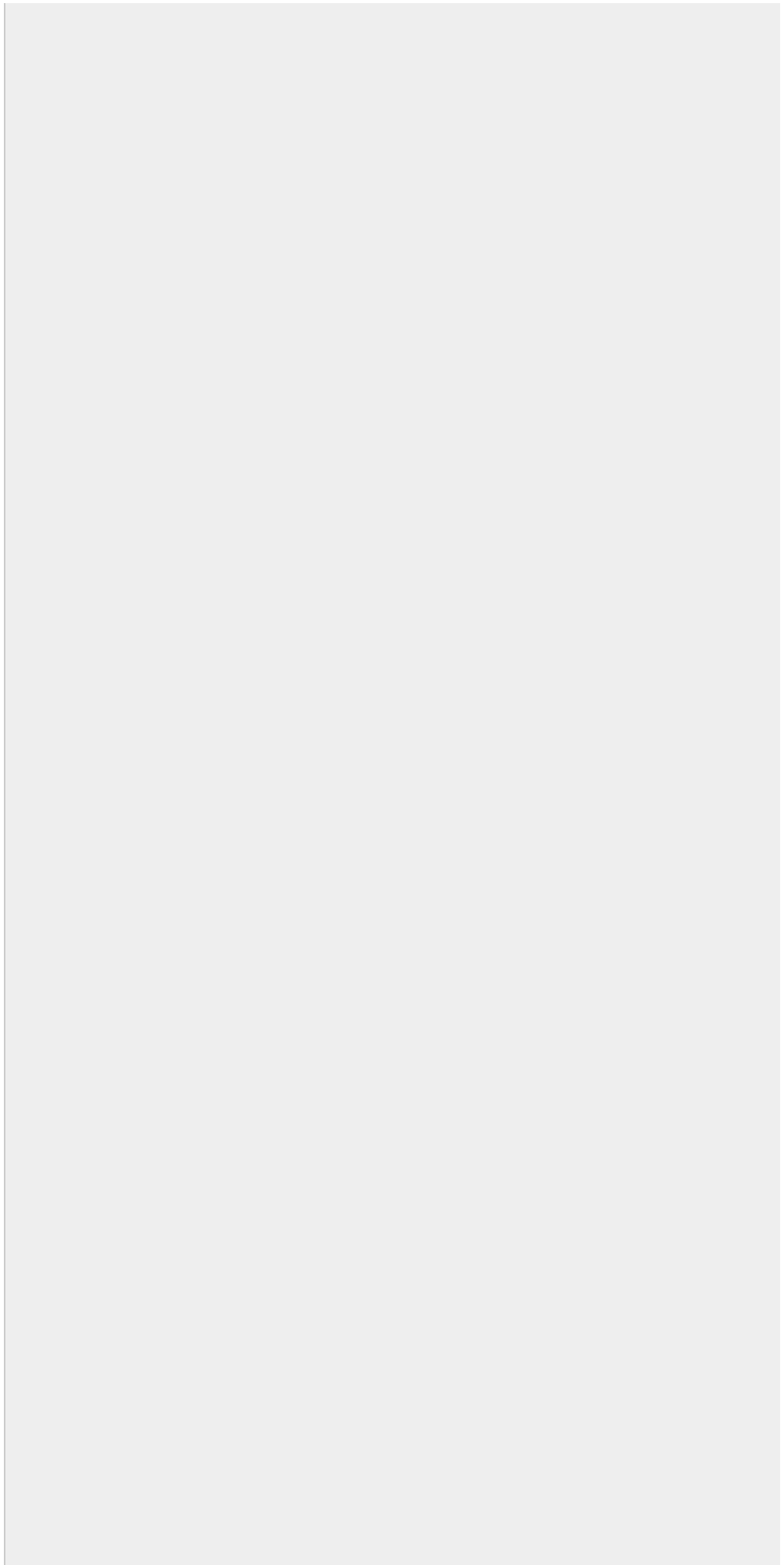
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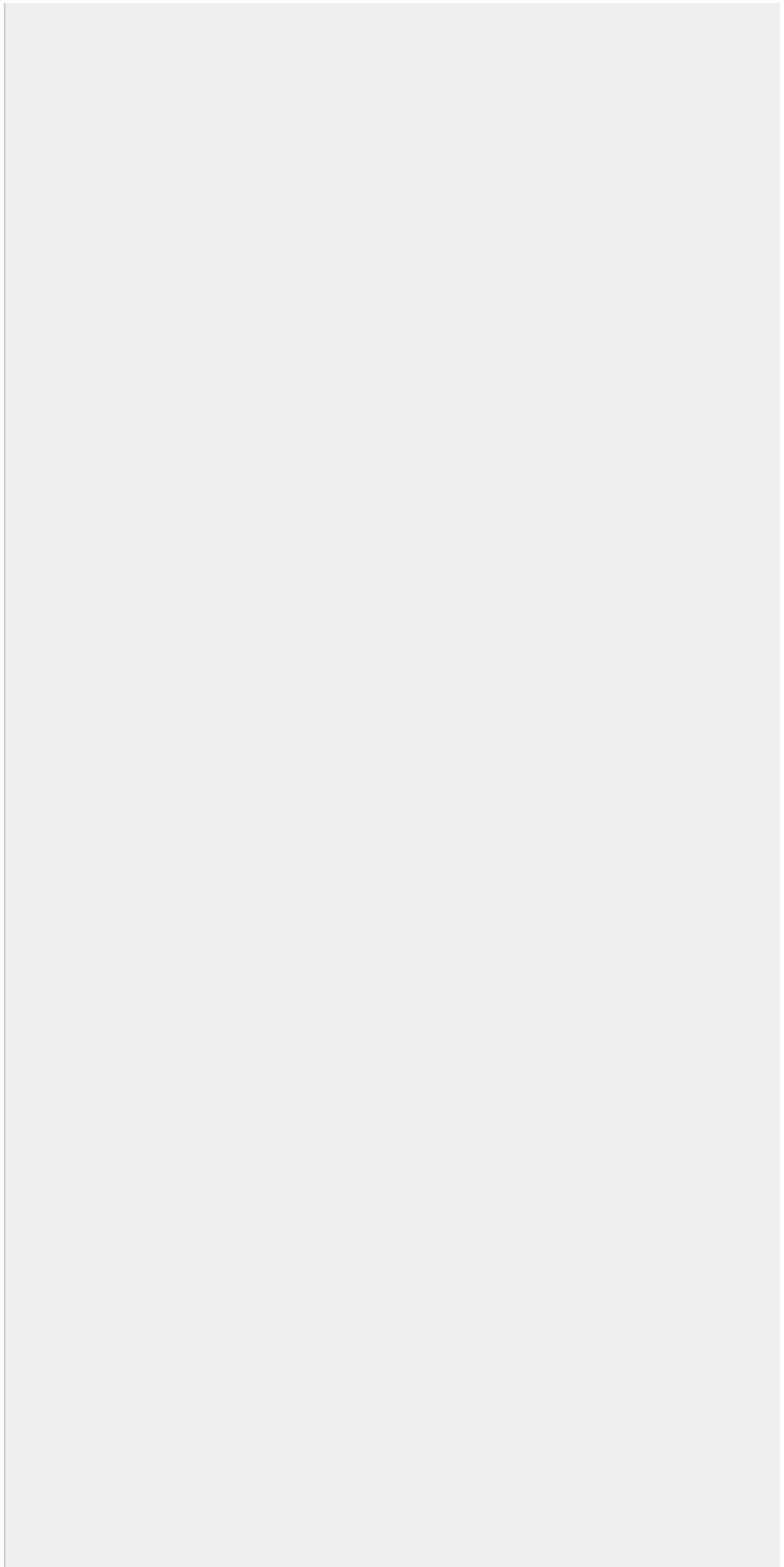
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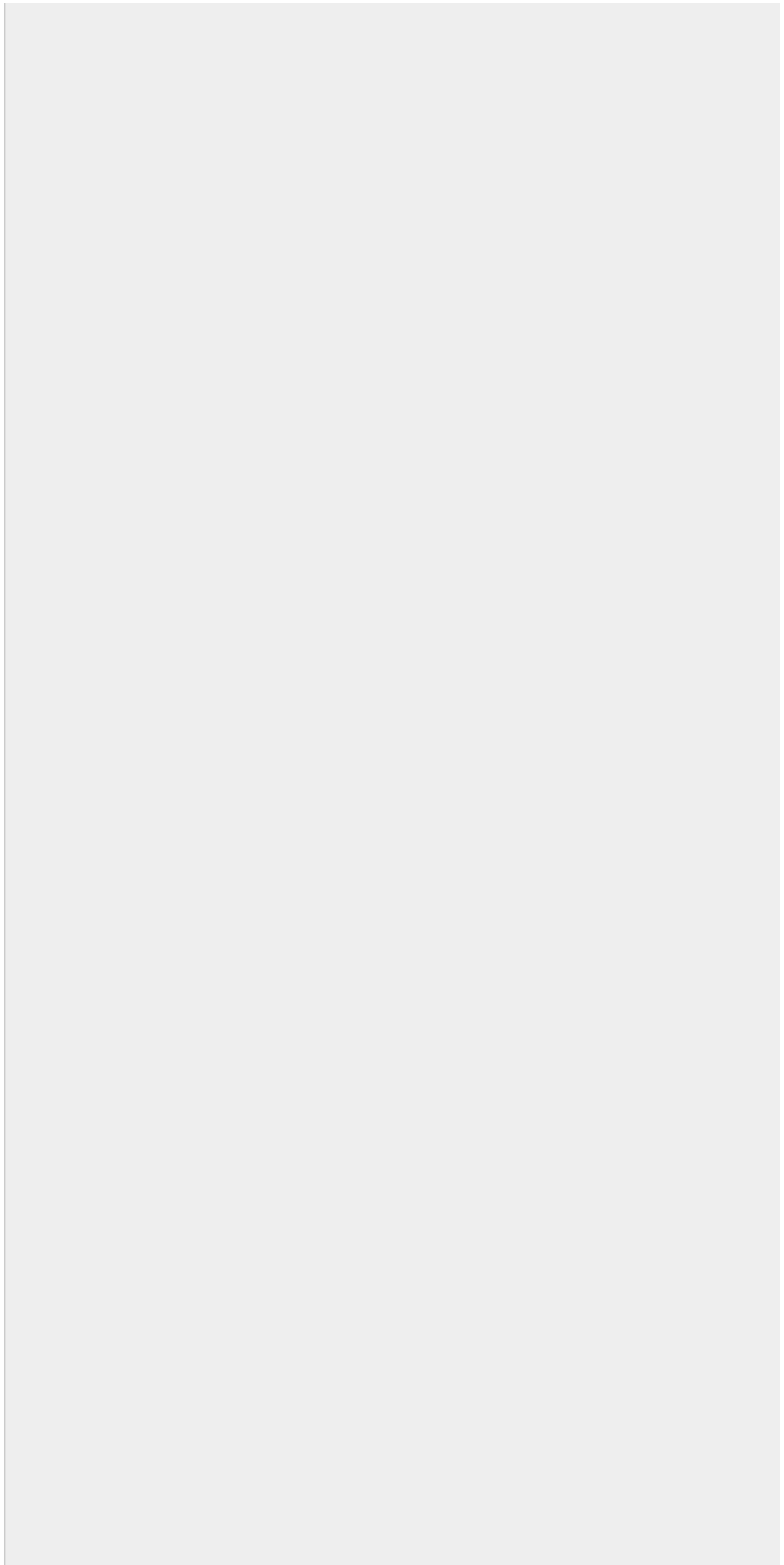
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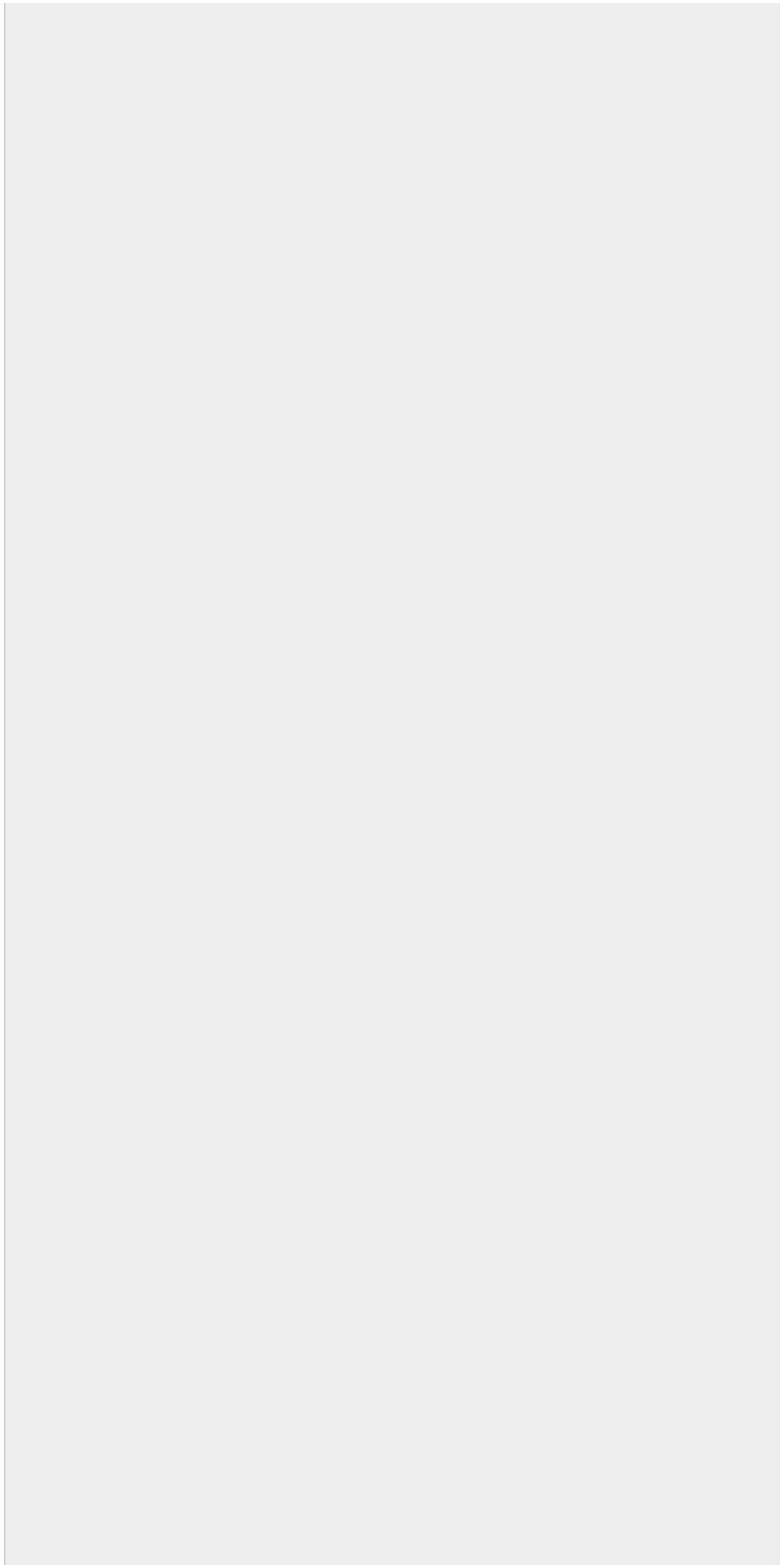
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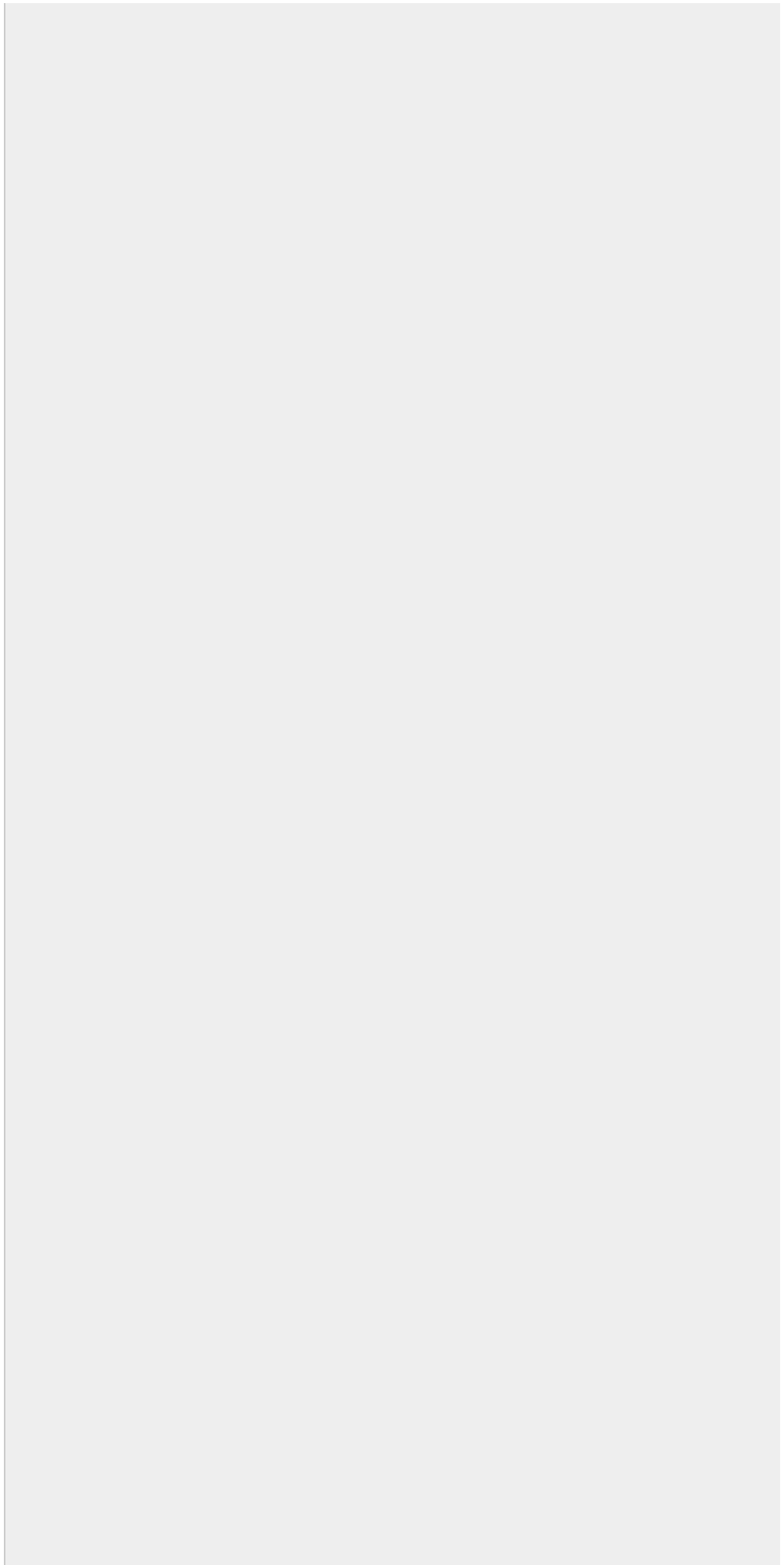
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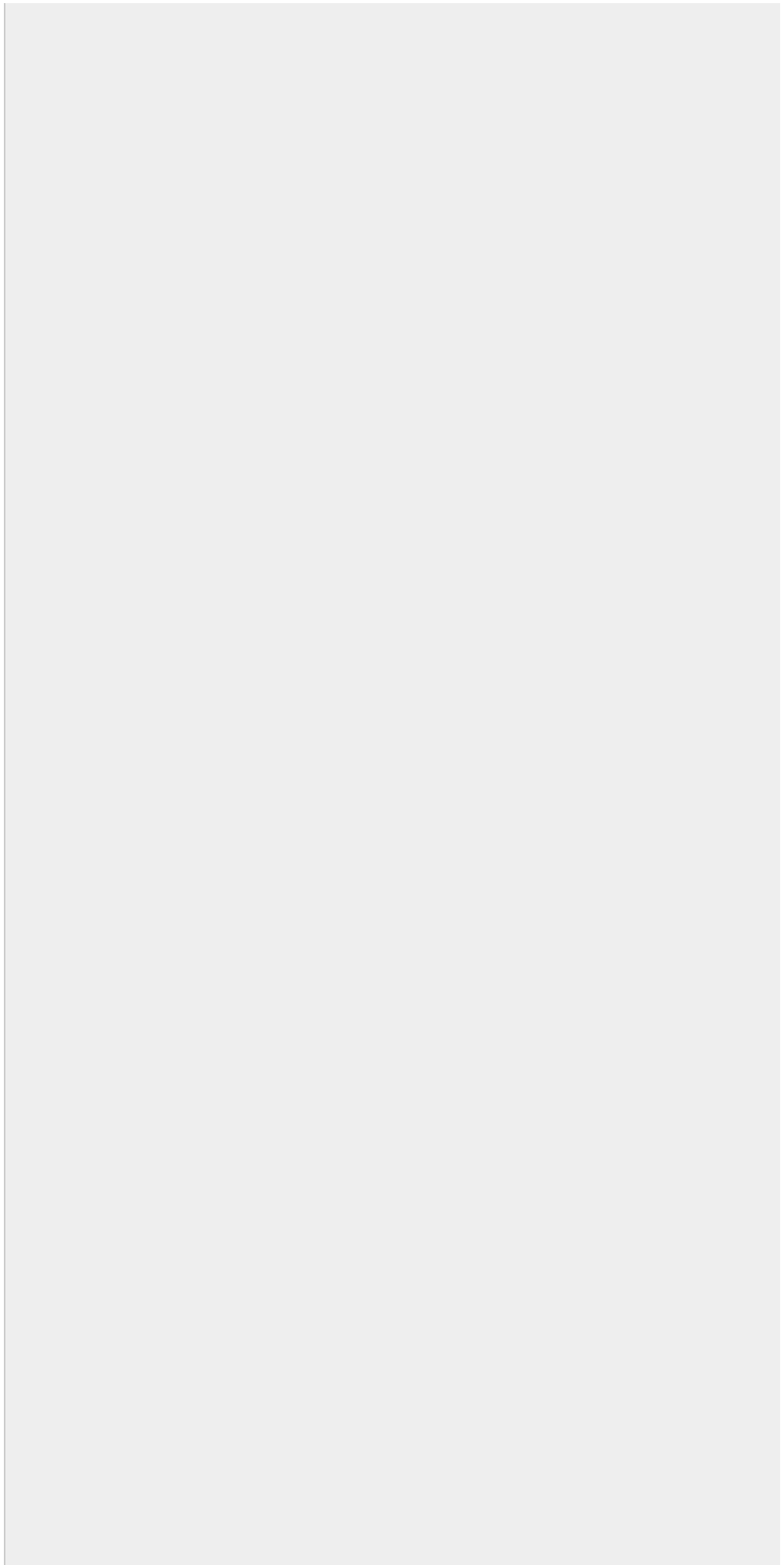


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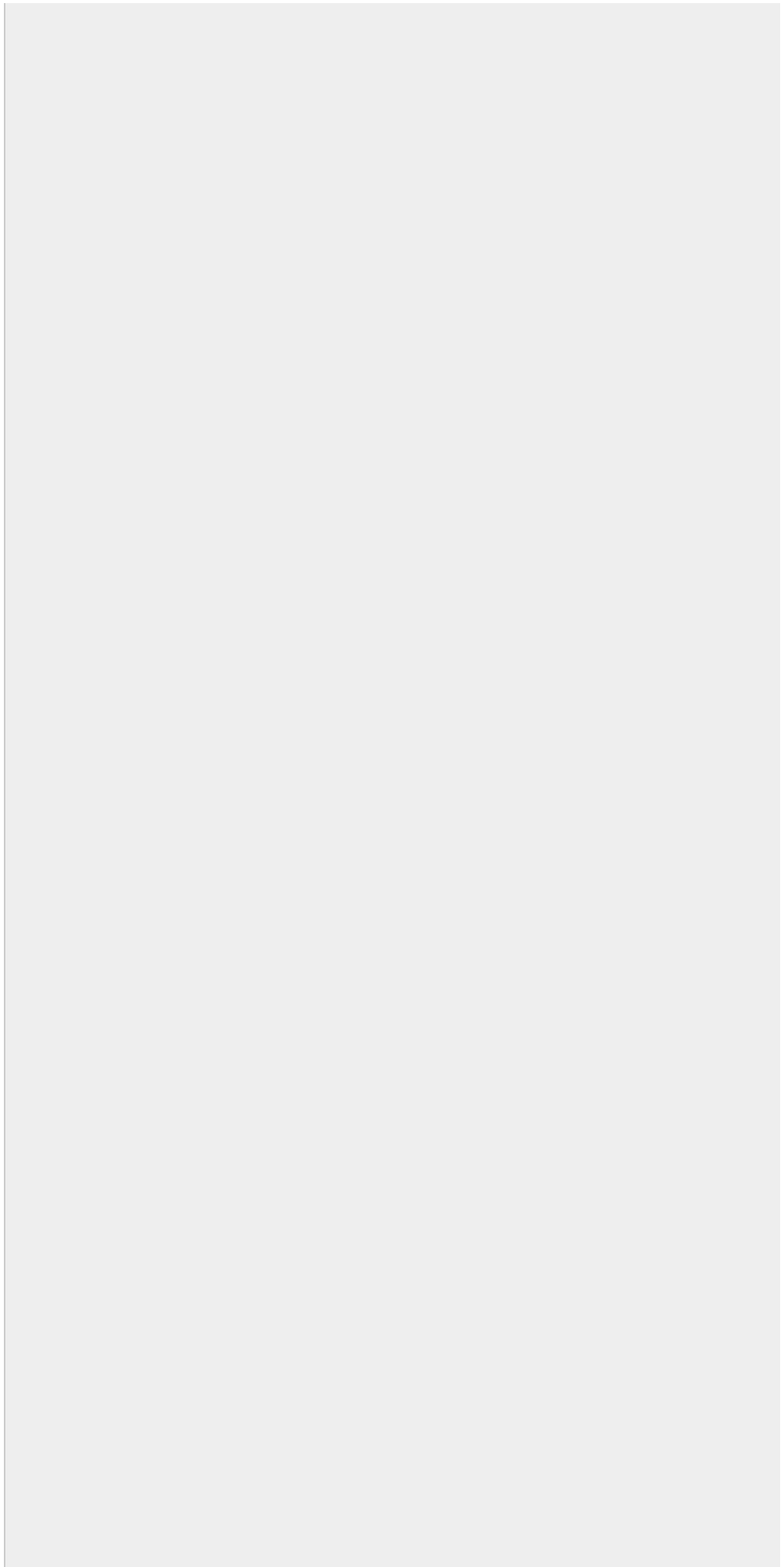




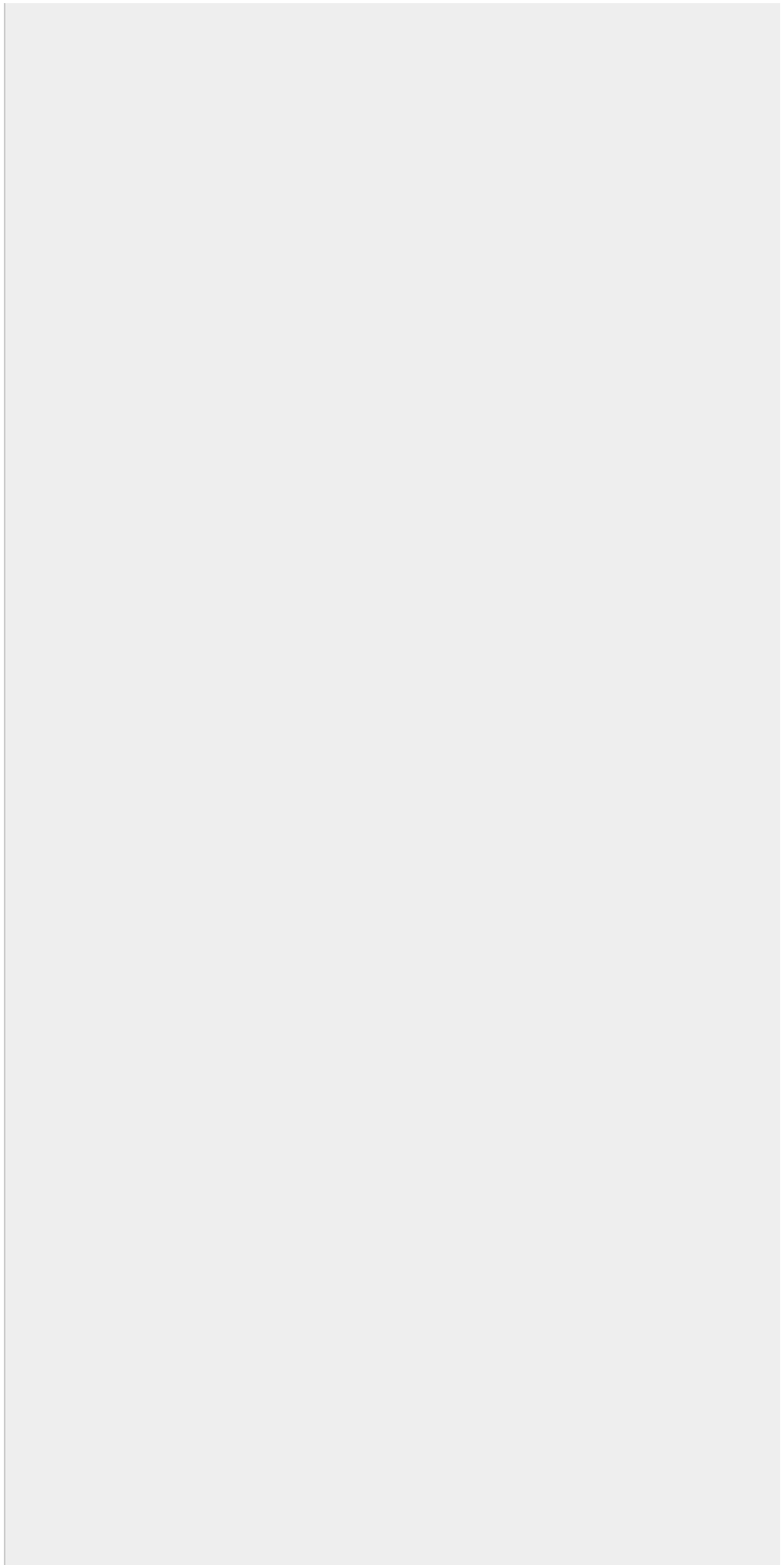
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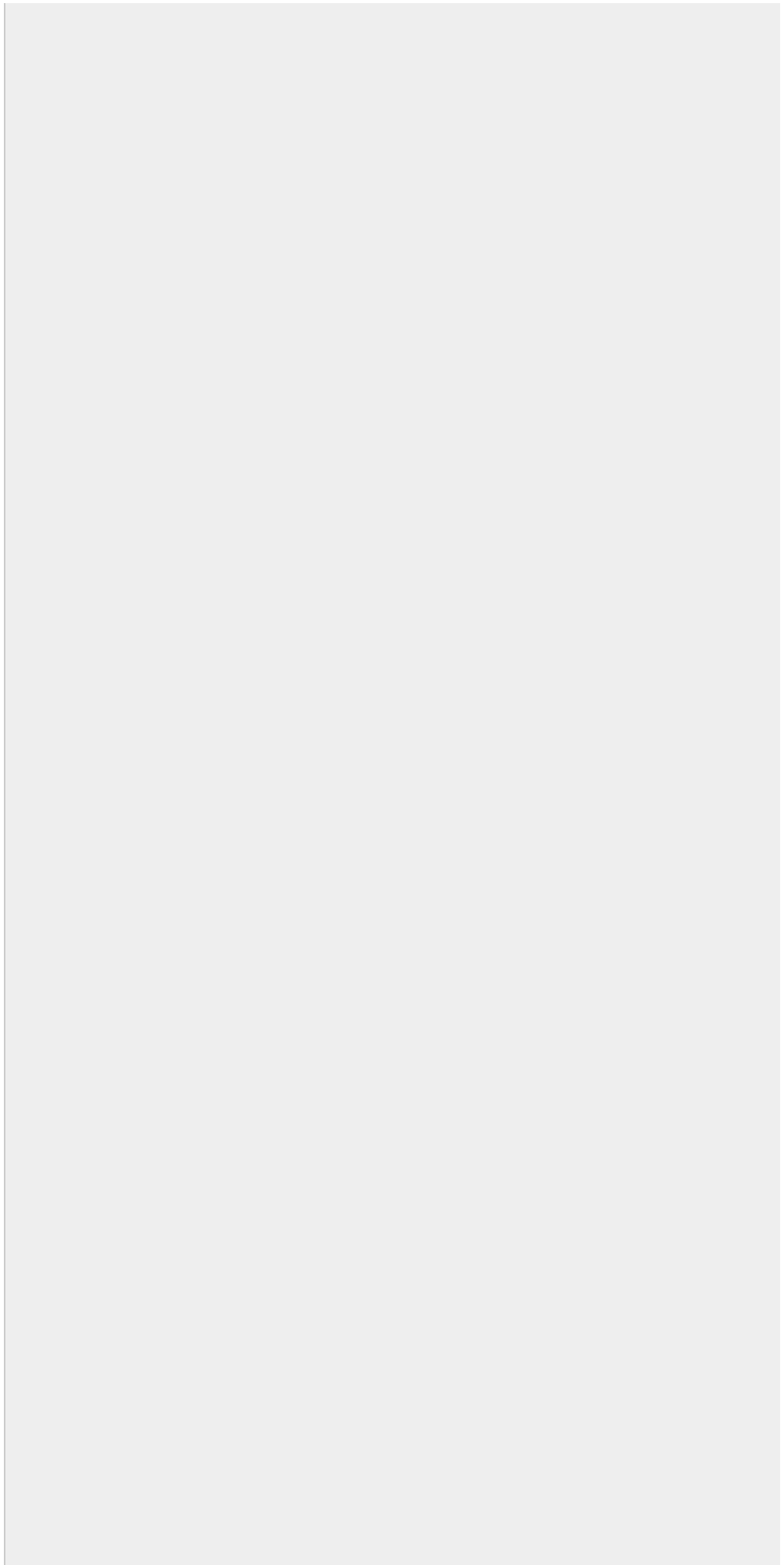
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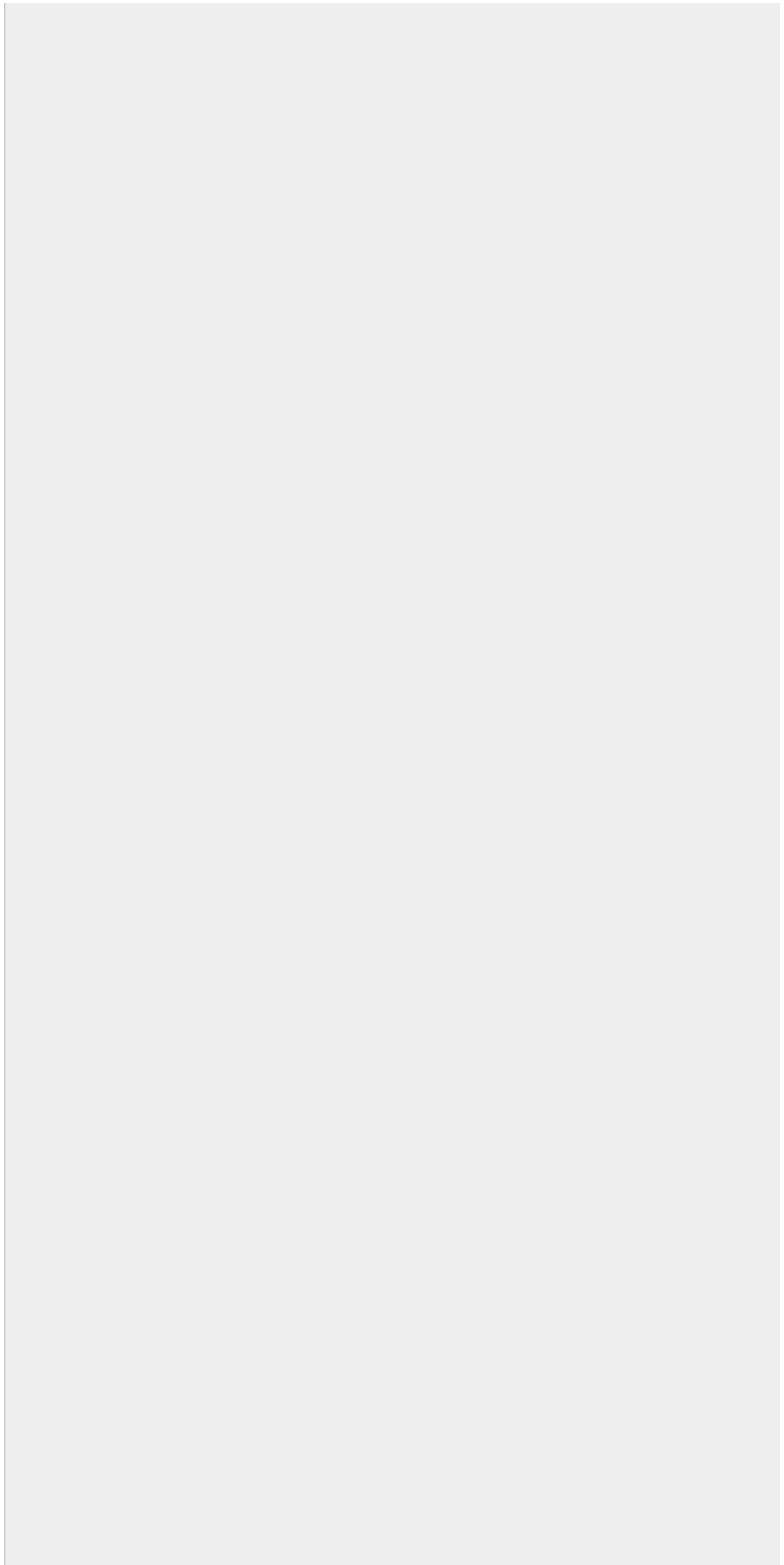
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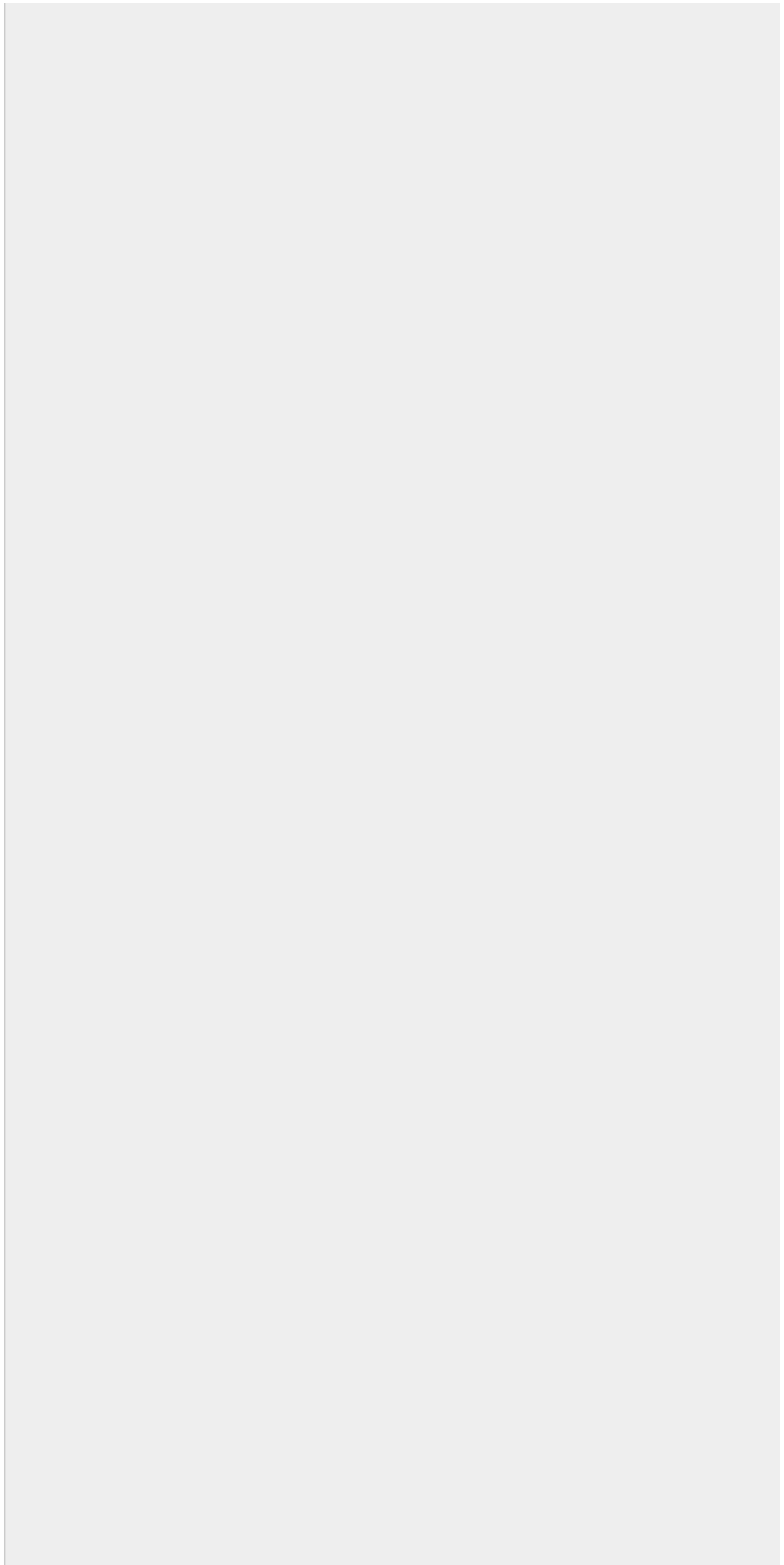
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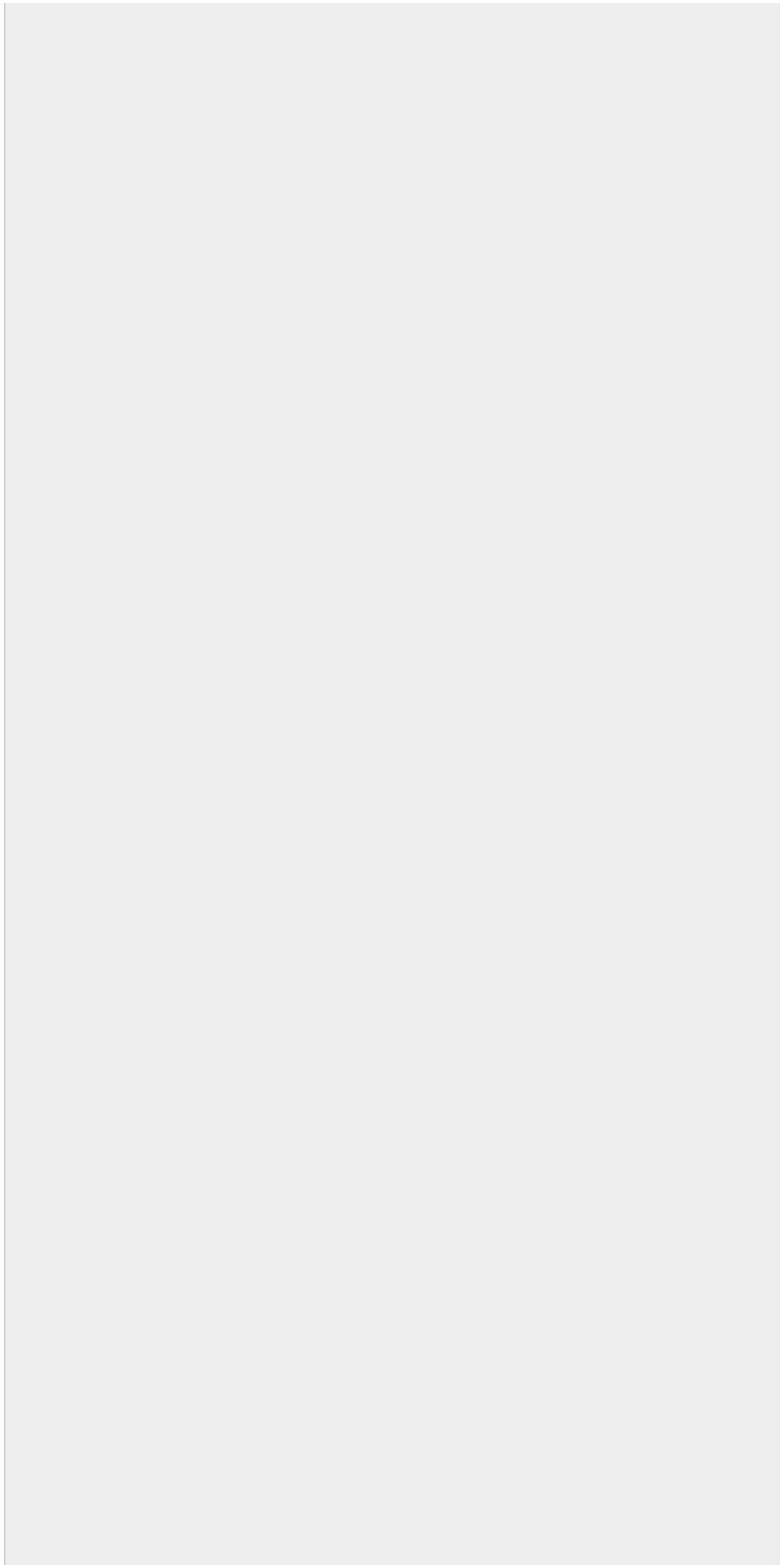
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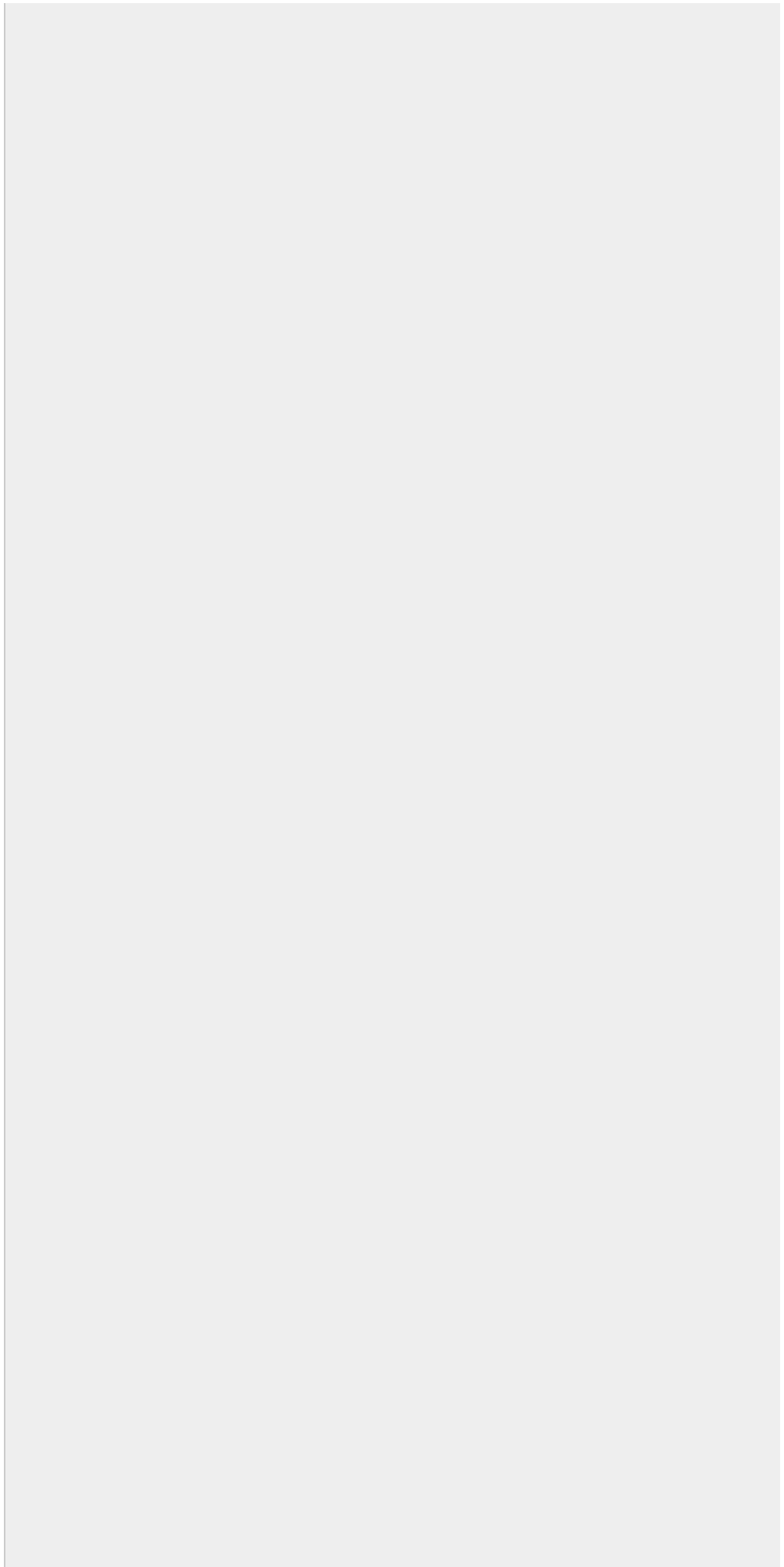
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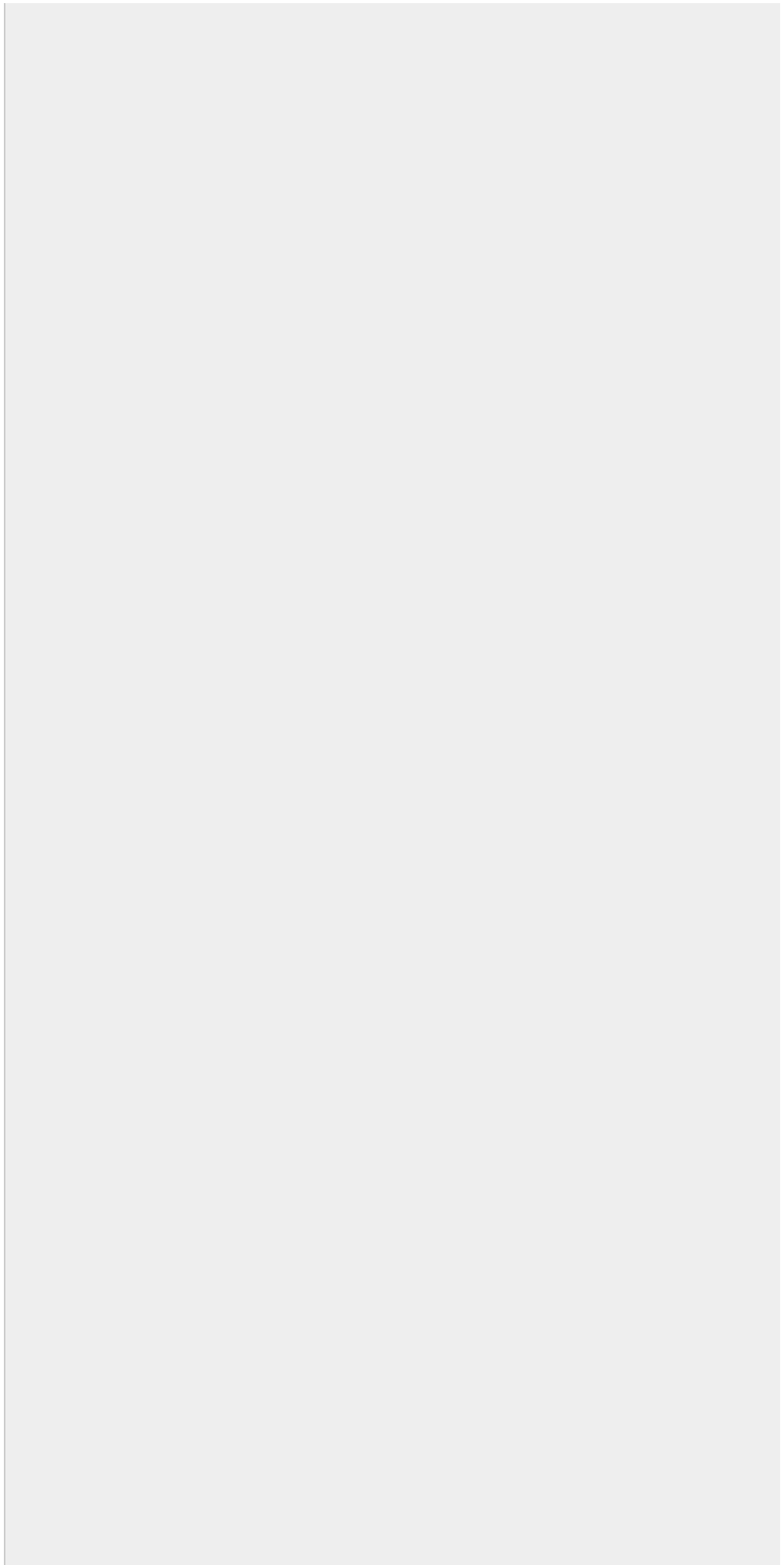


- 755 (2005)      ∨
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- 750 (2005)      ∨
- 747 (2005)      ∨
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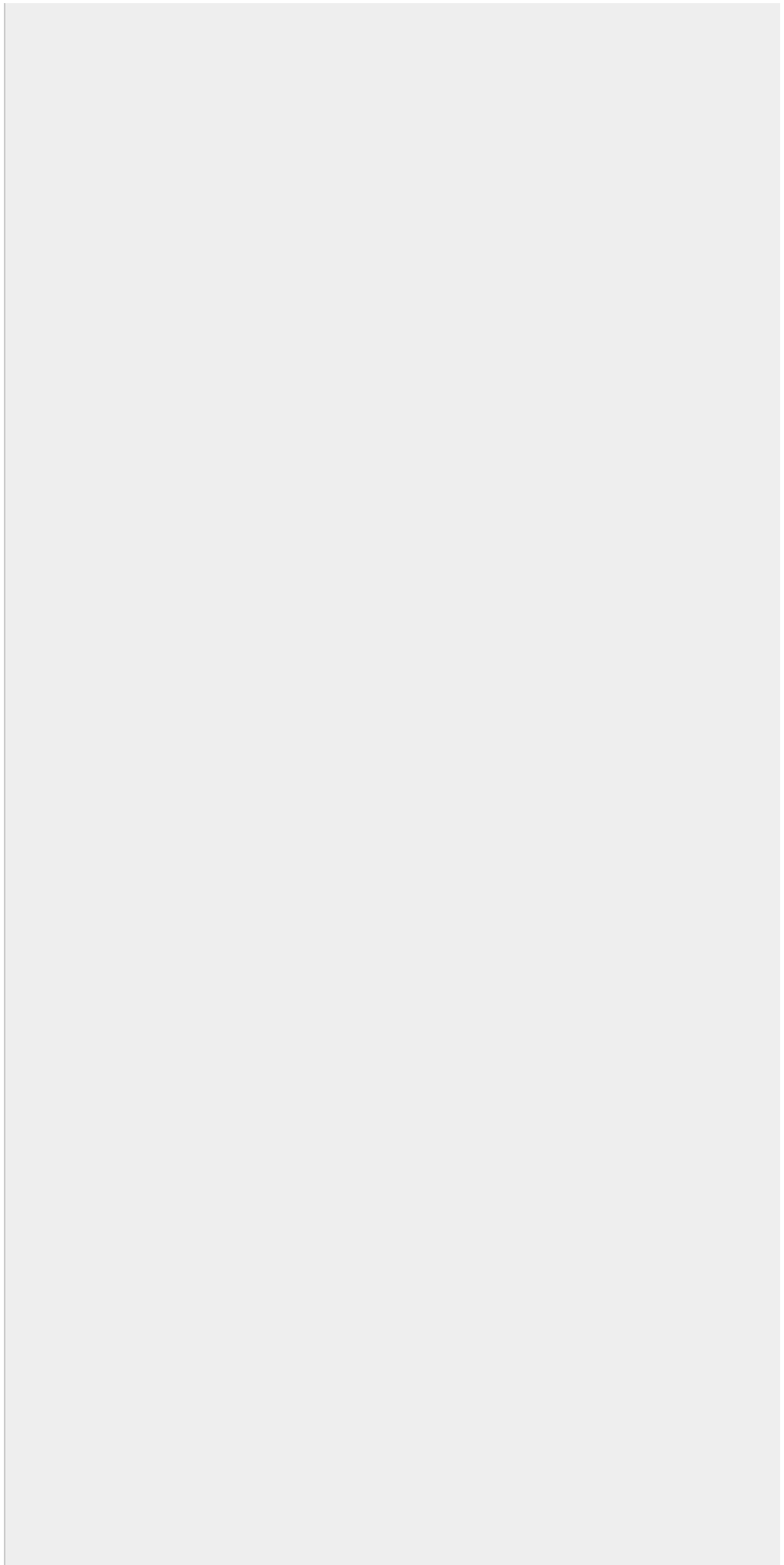




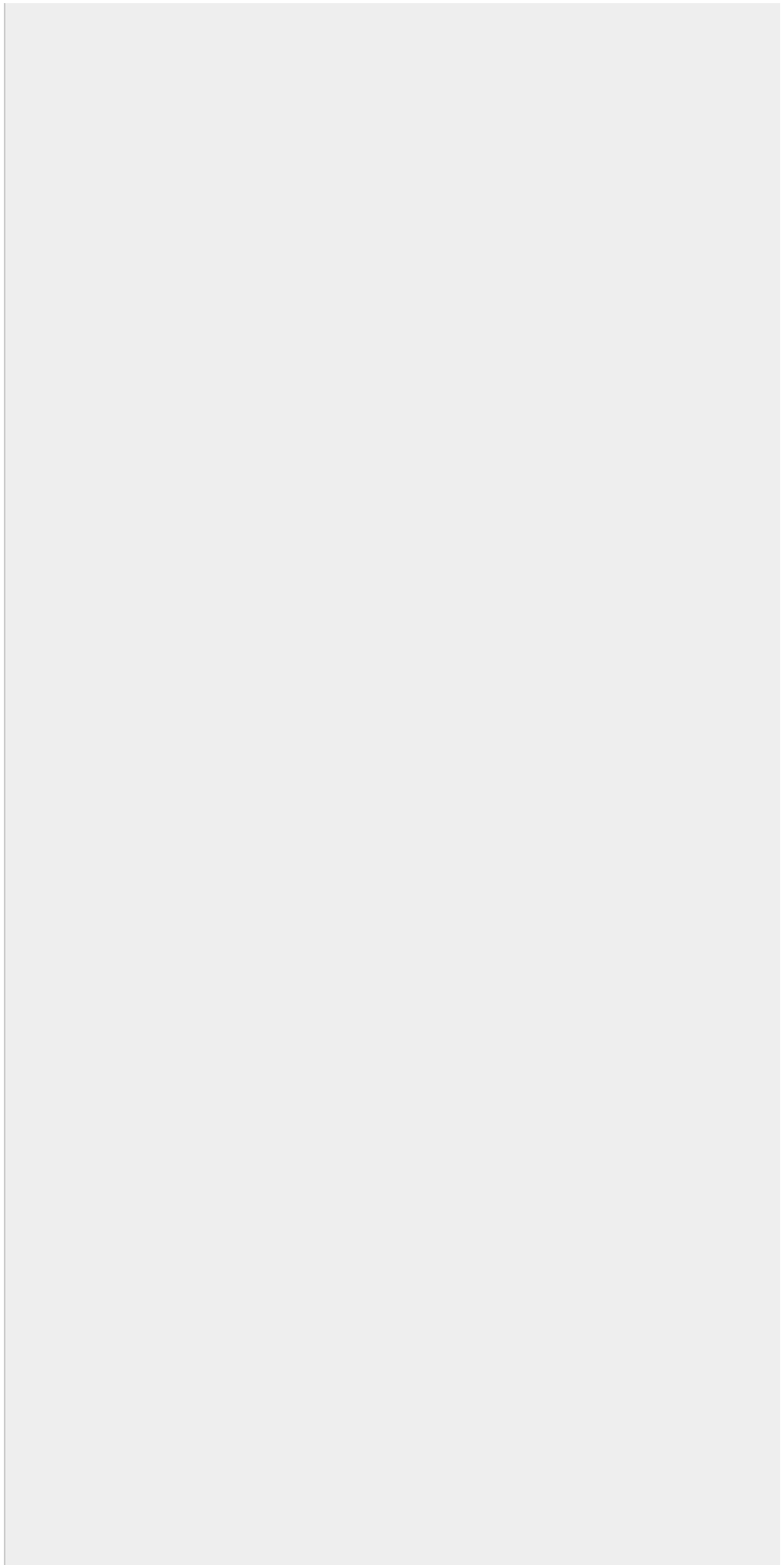
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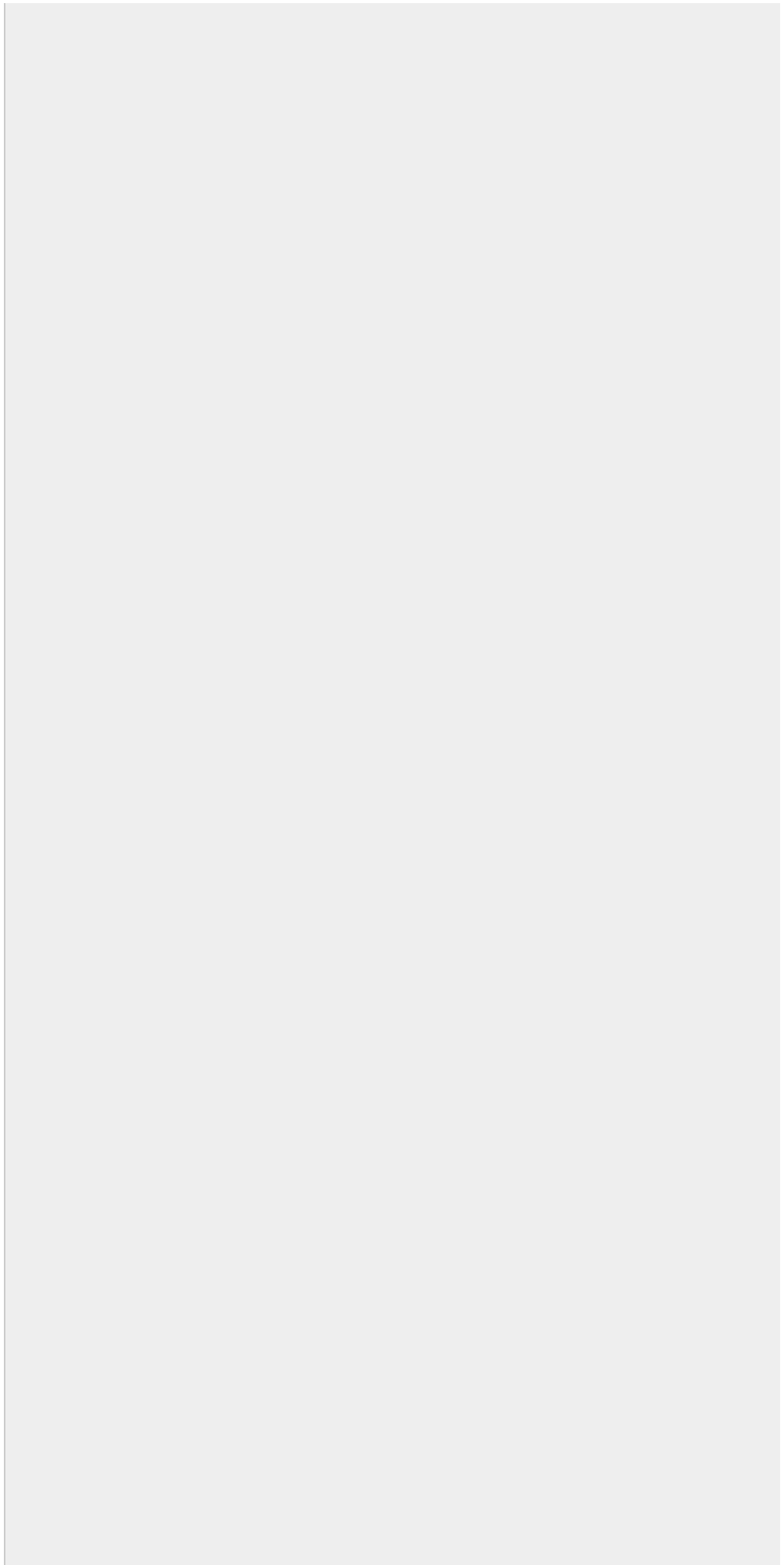
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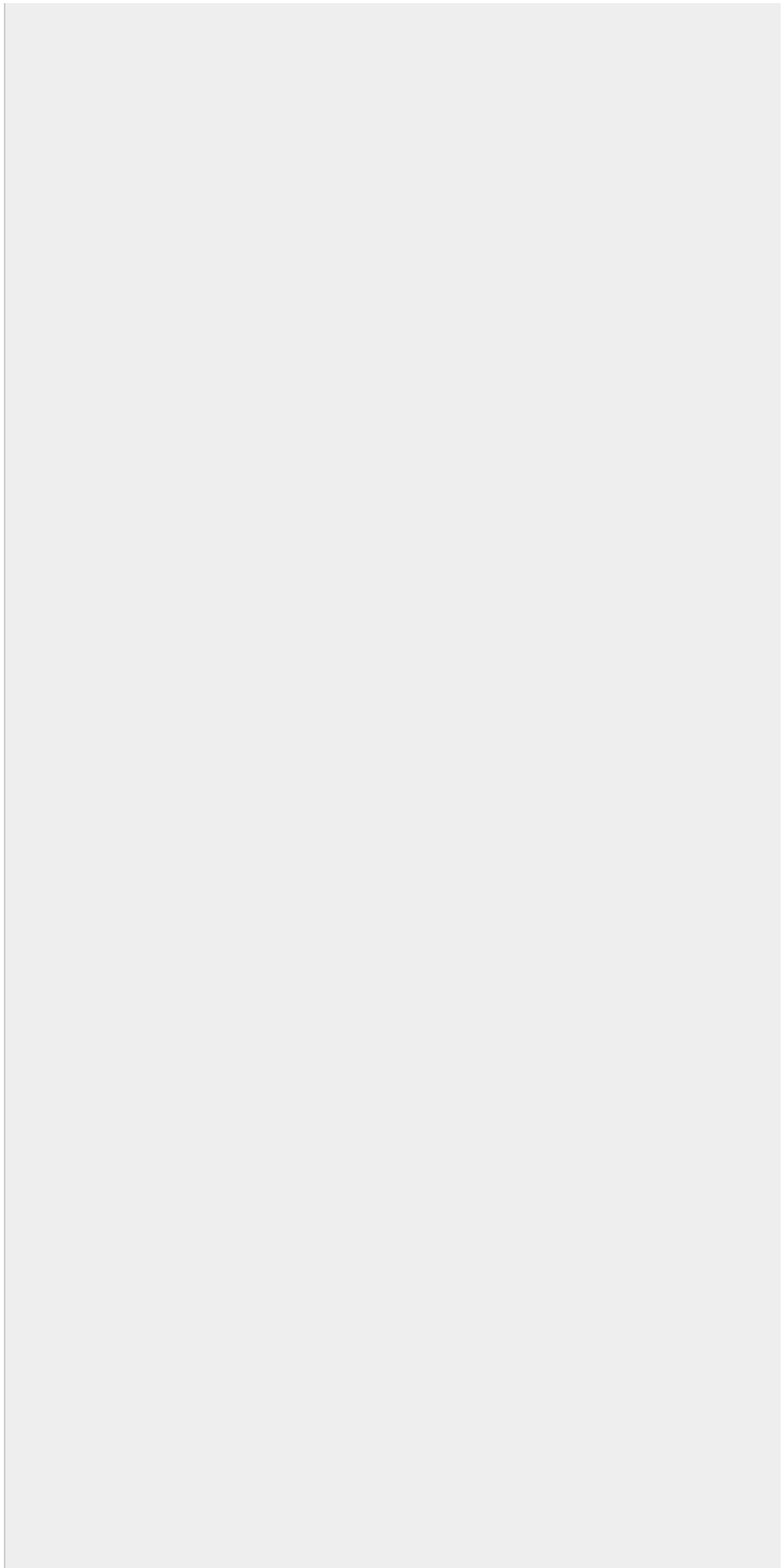
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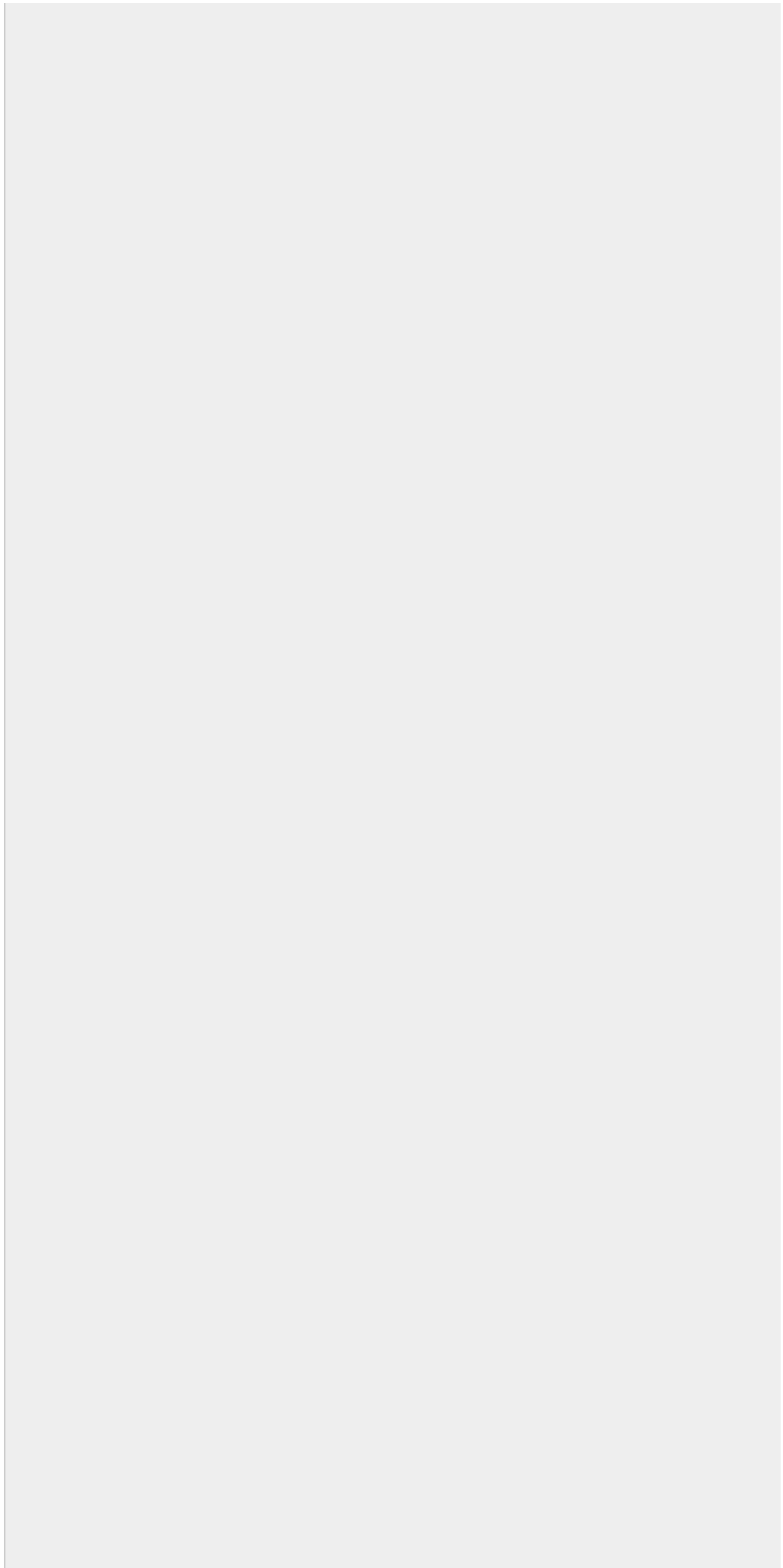
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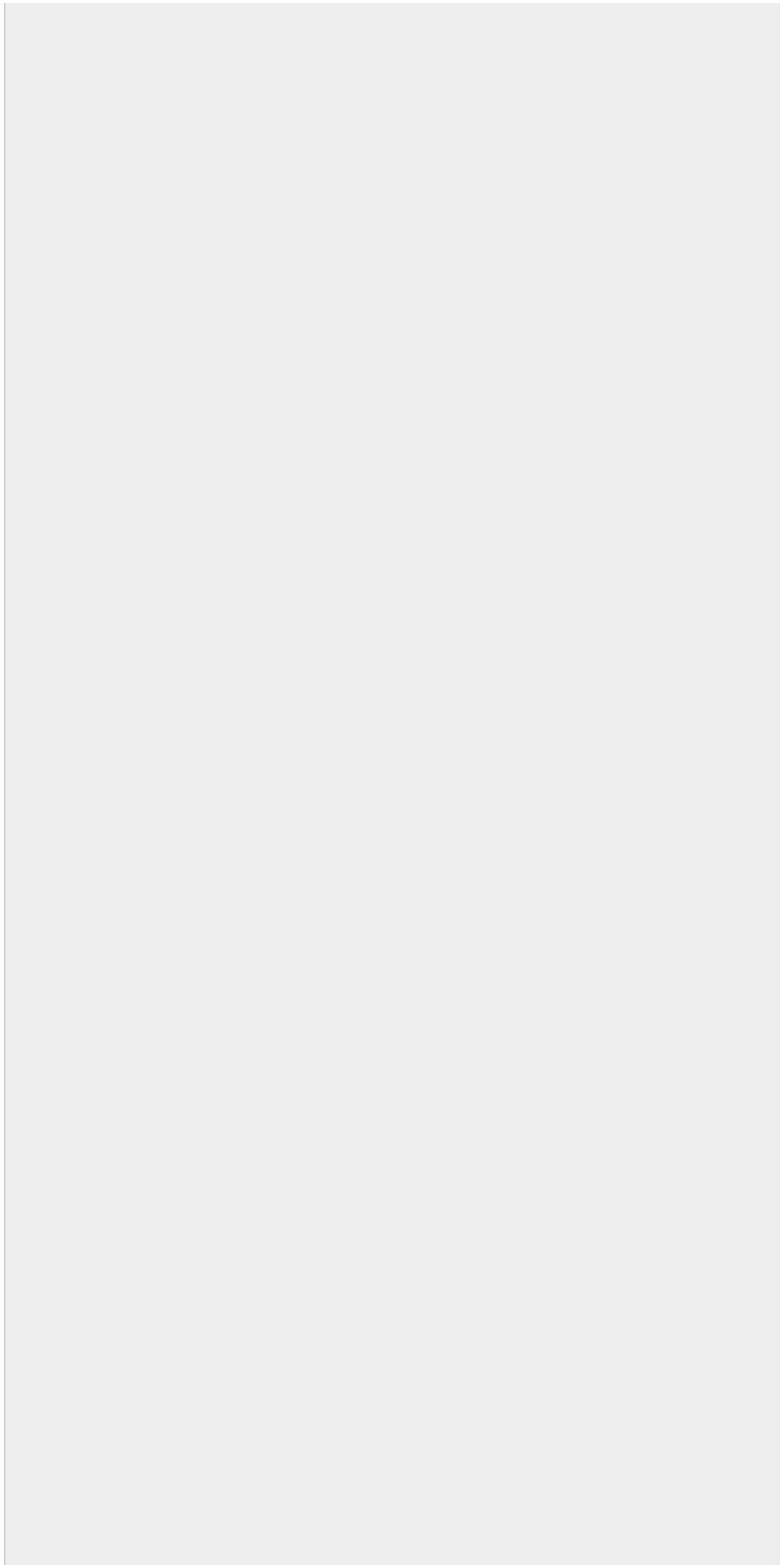
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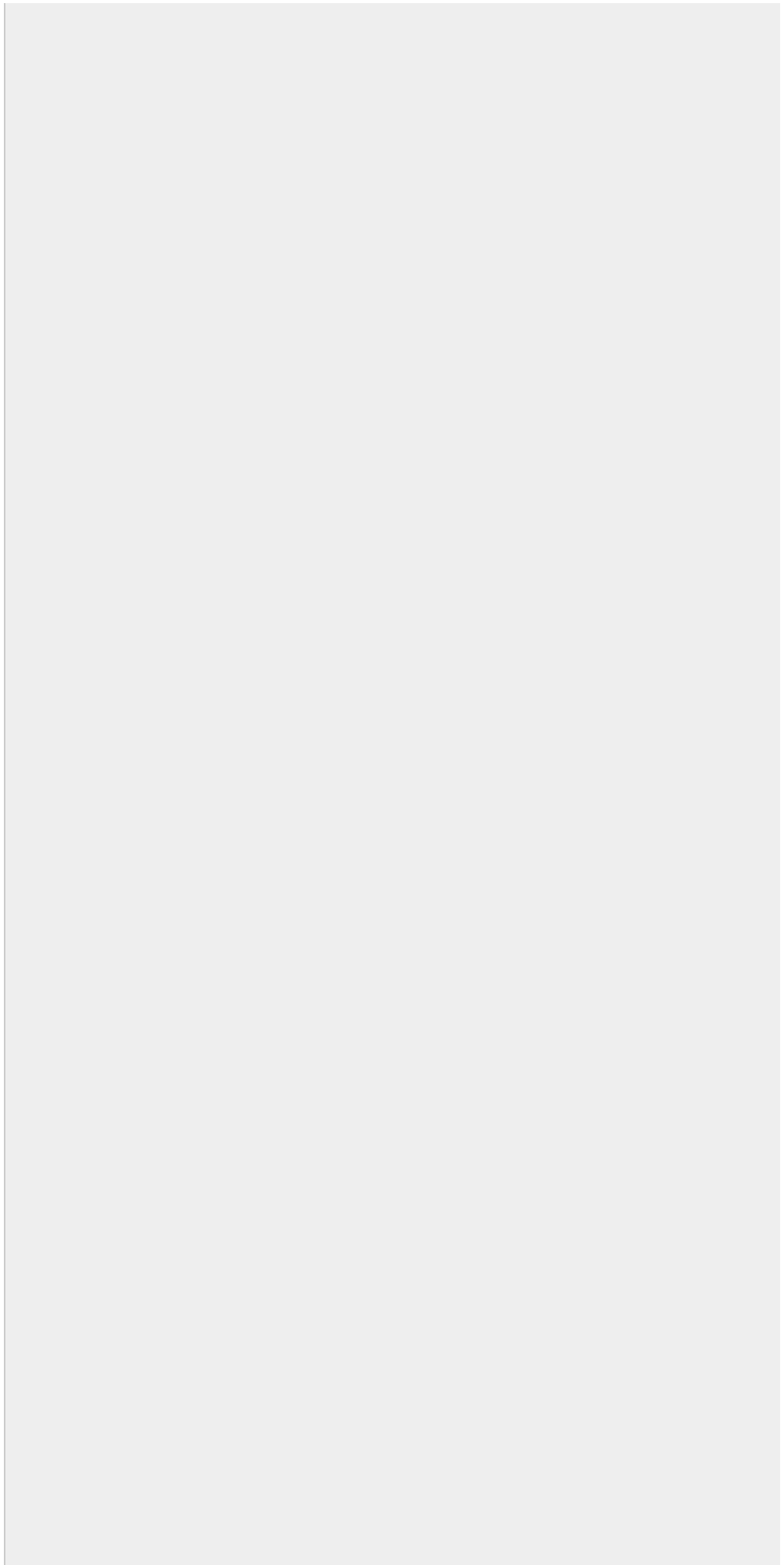
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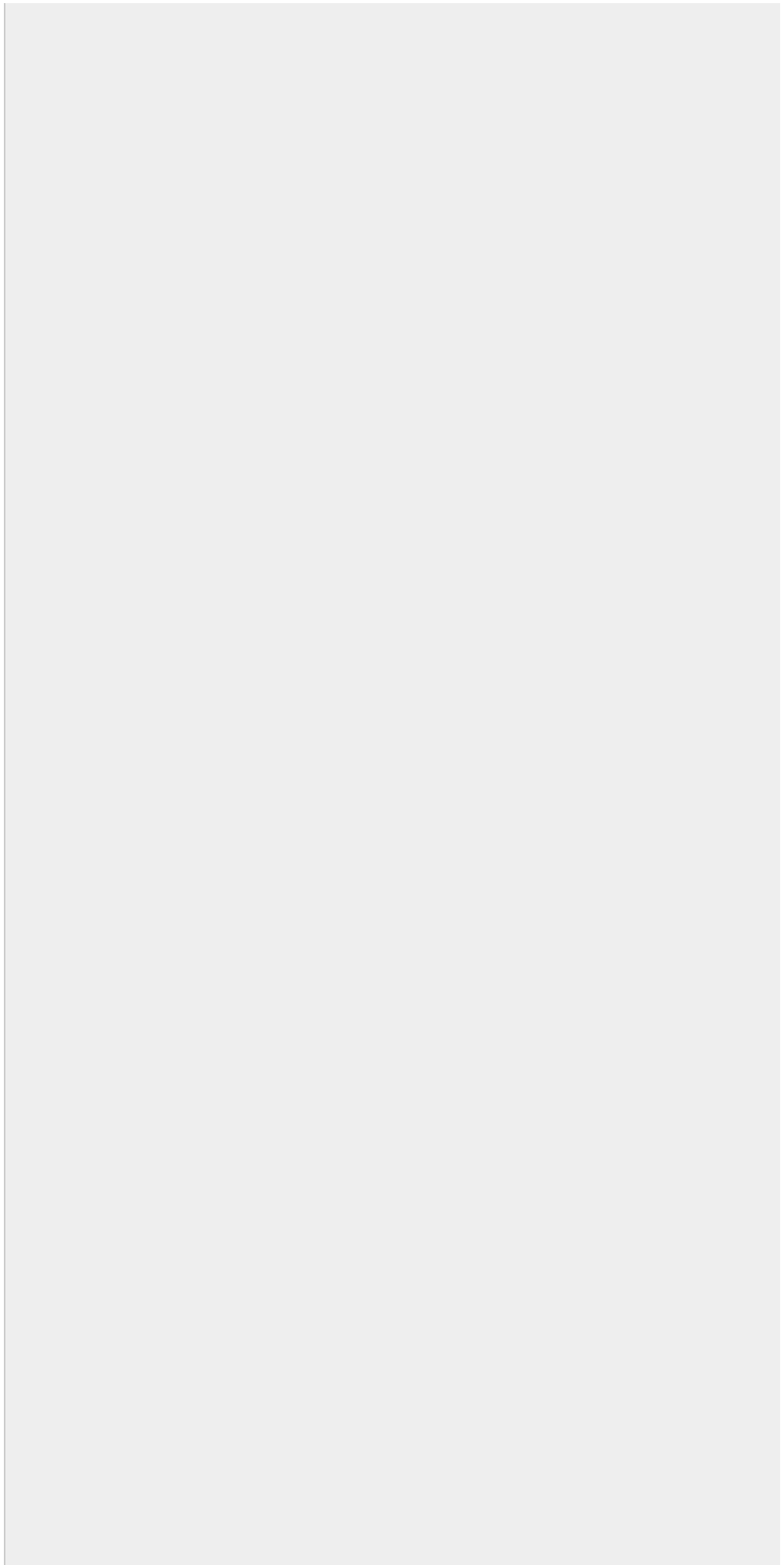


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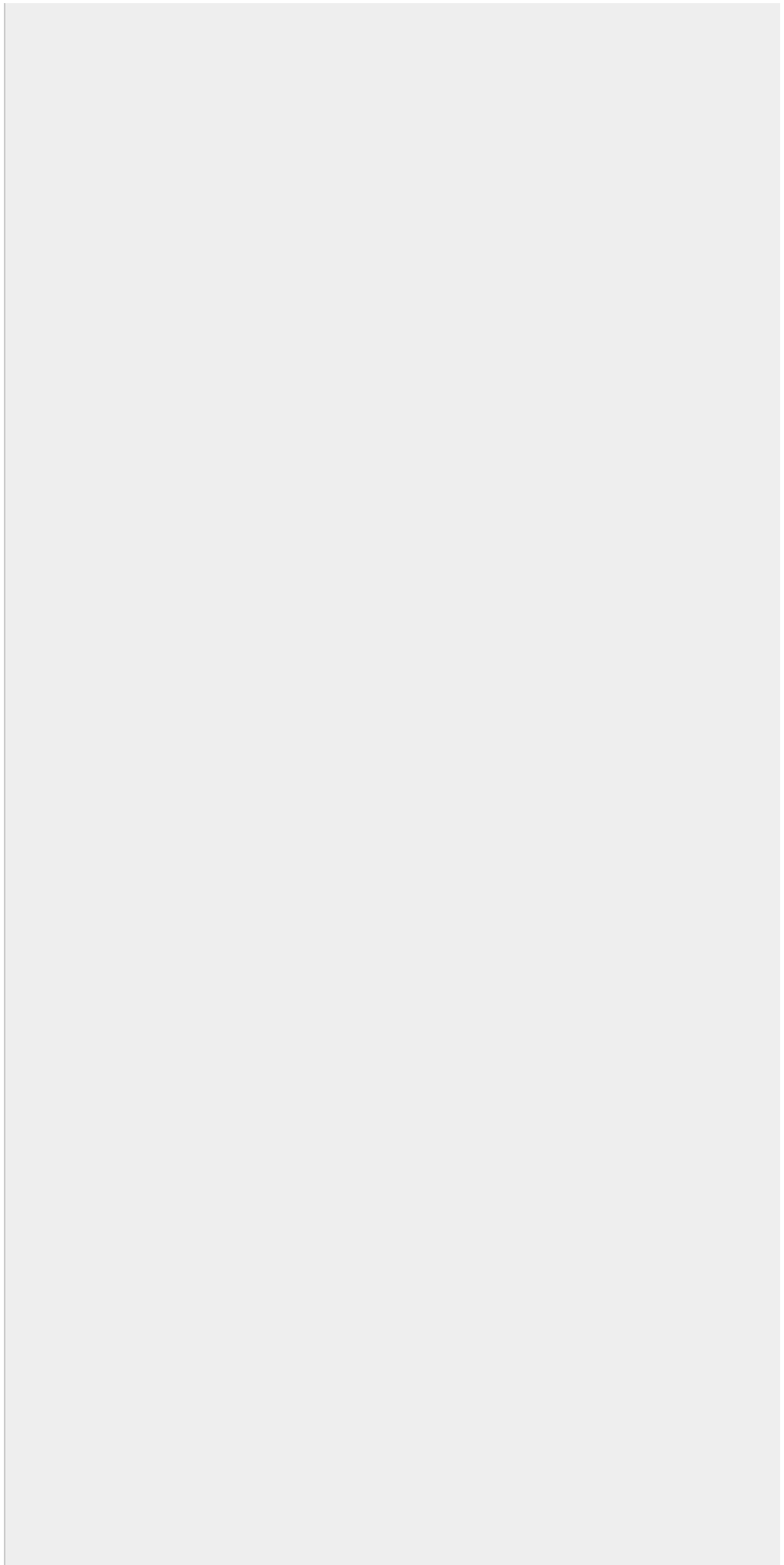




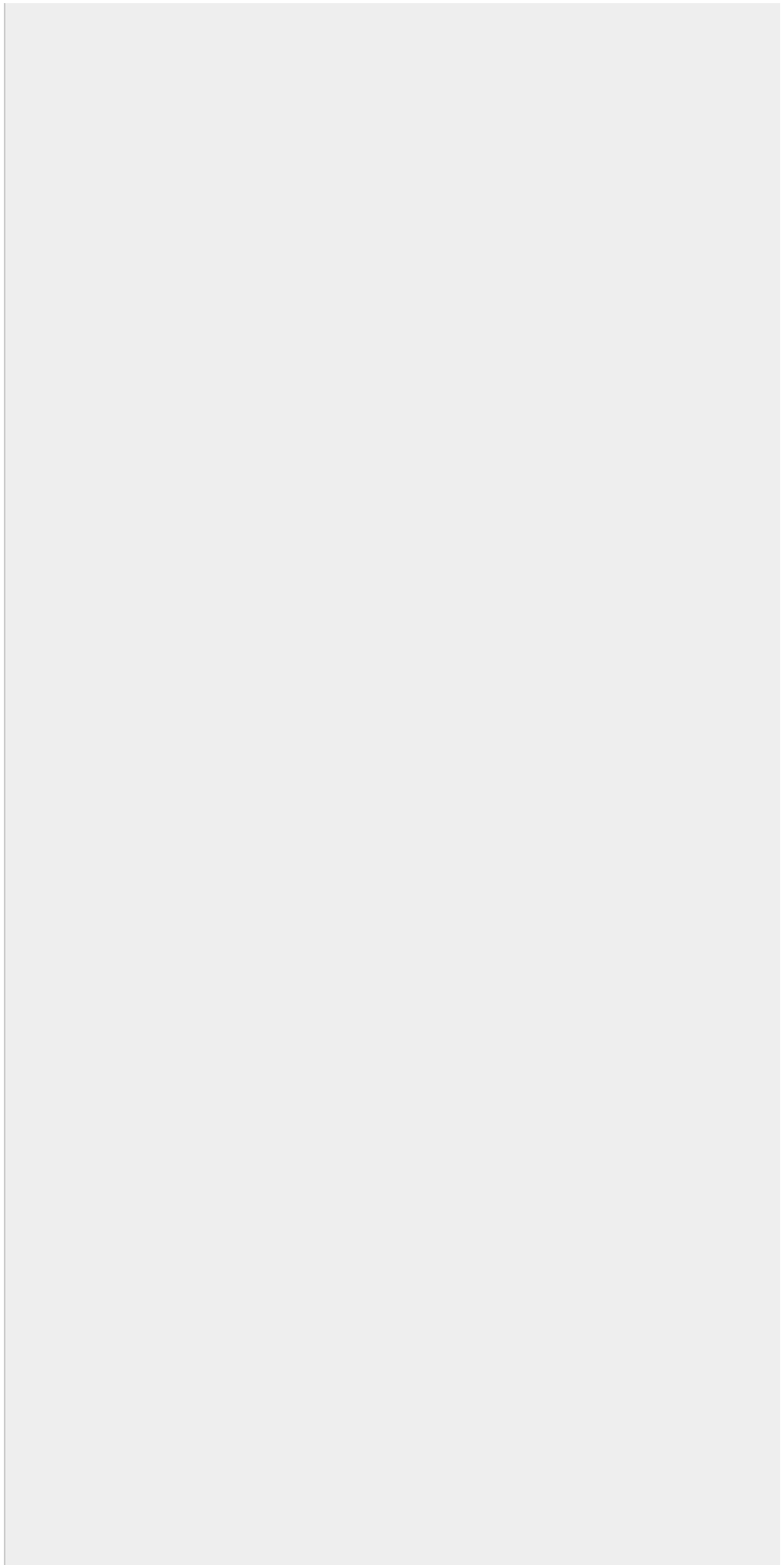
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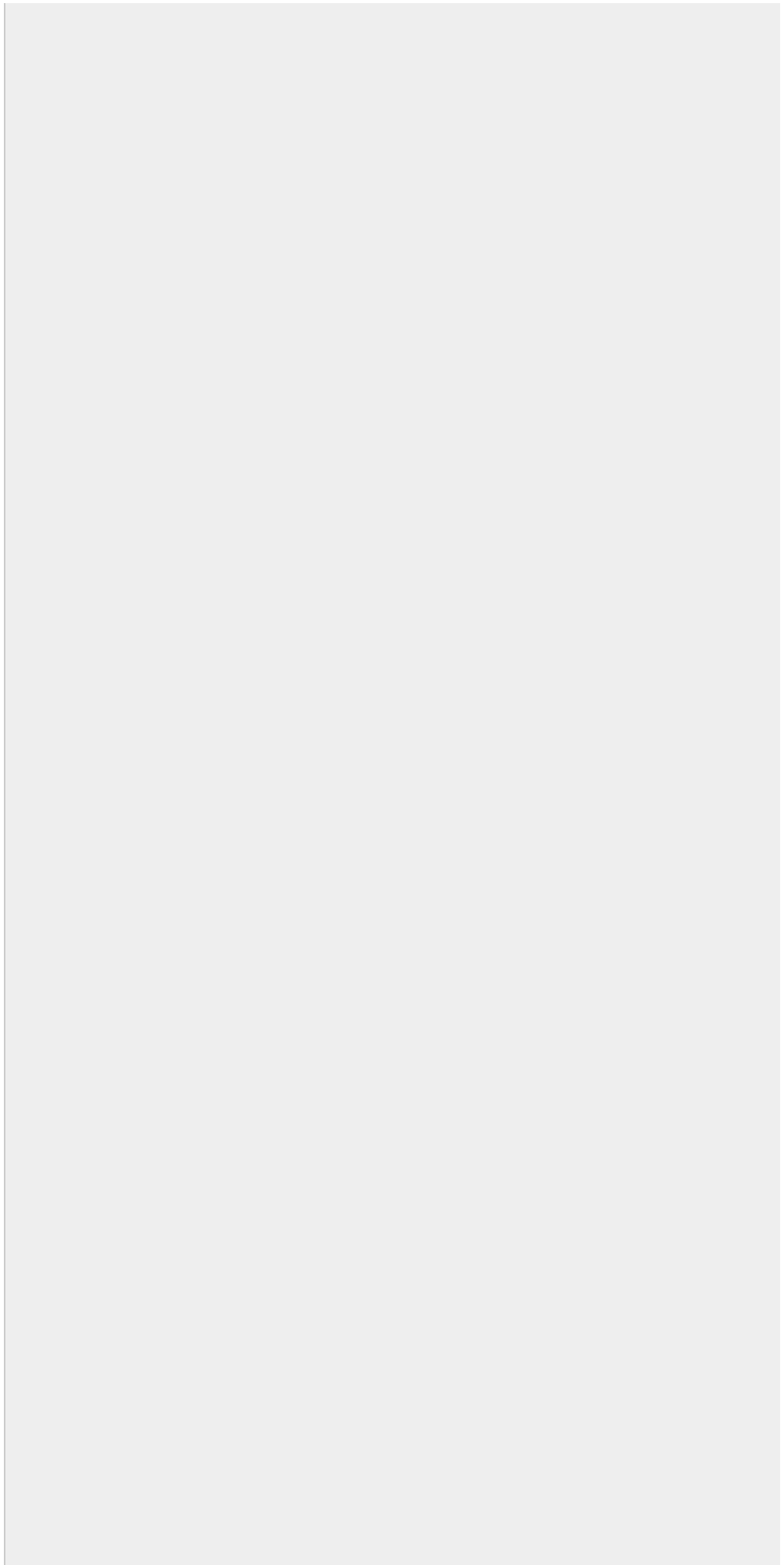
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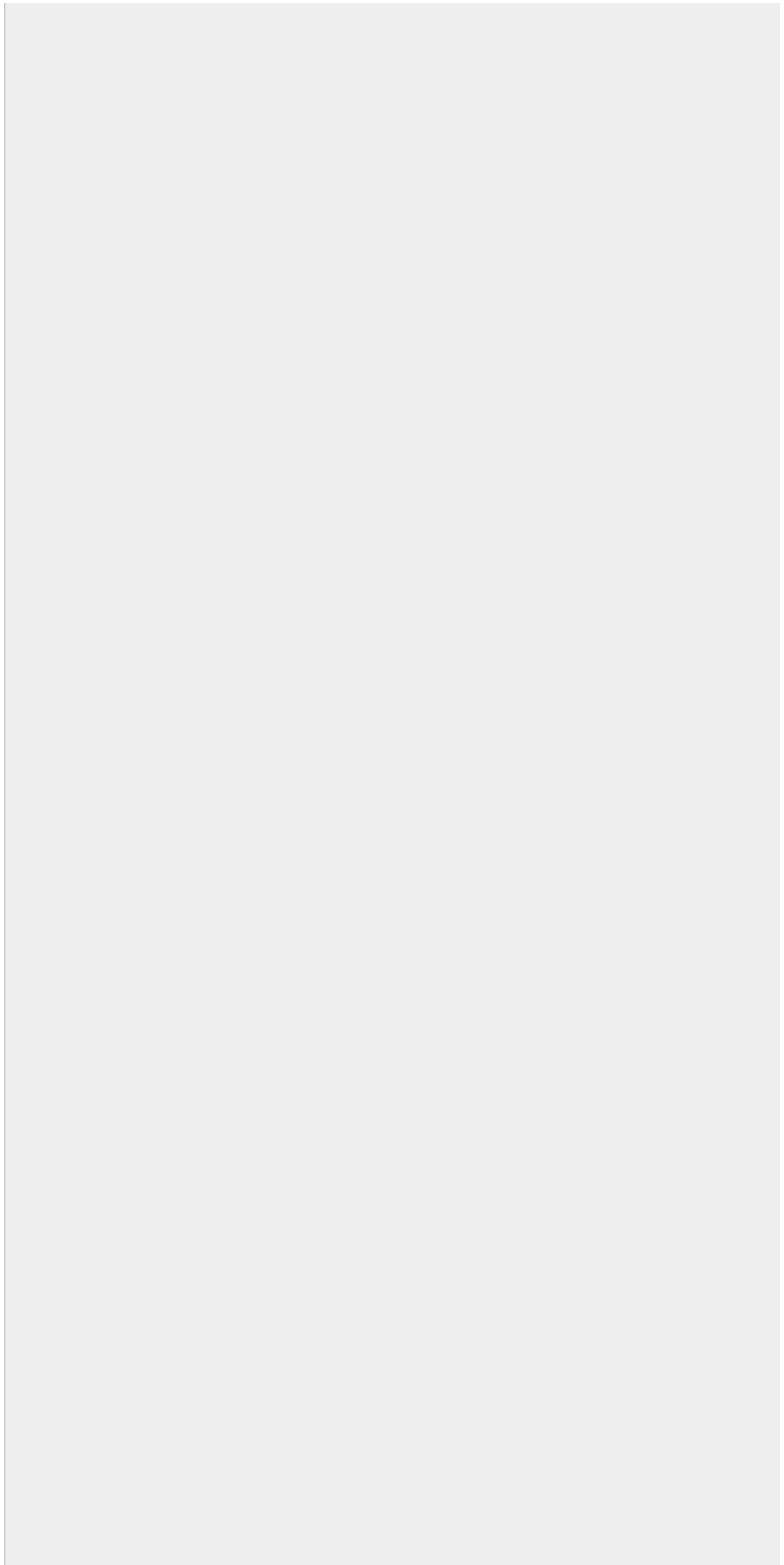
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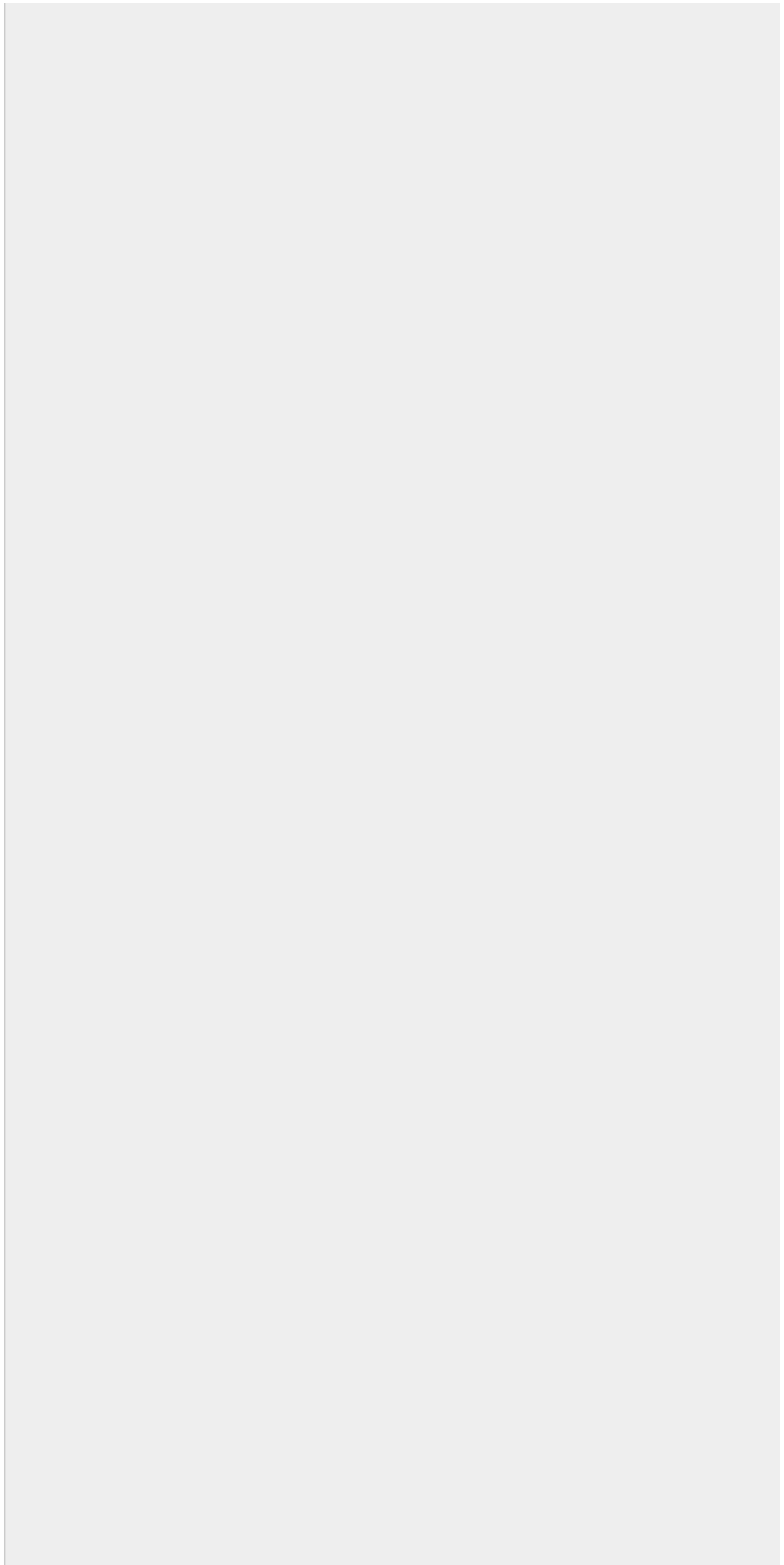
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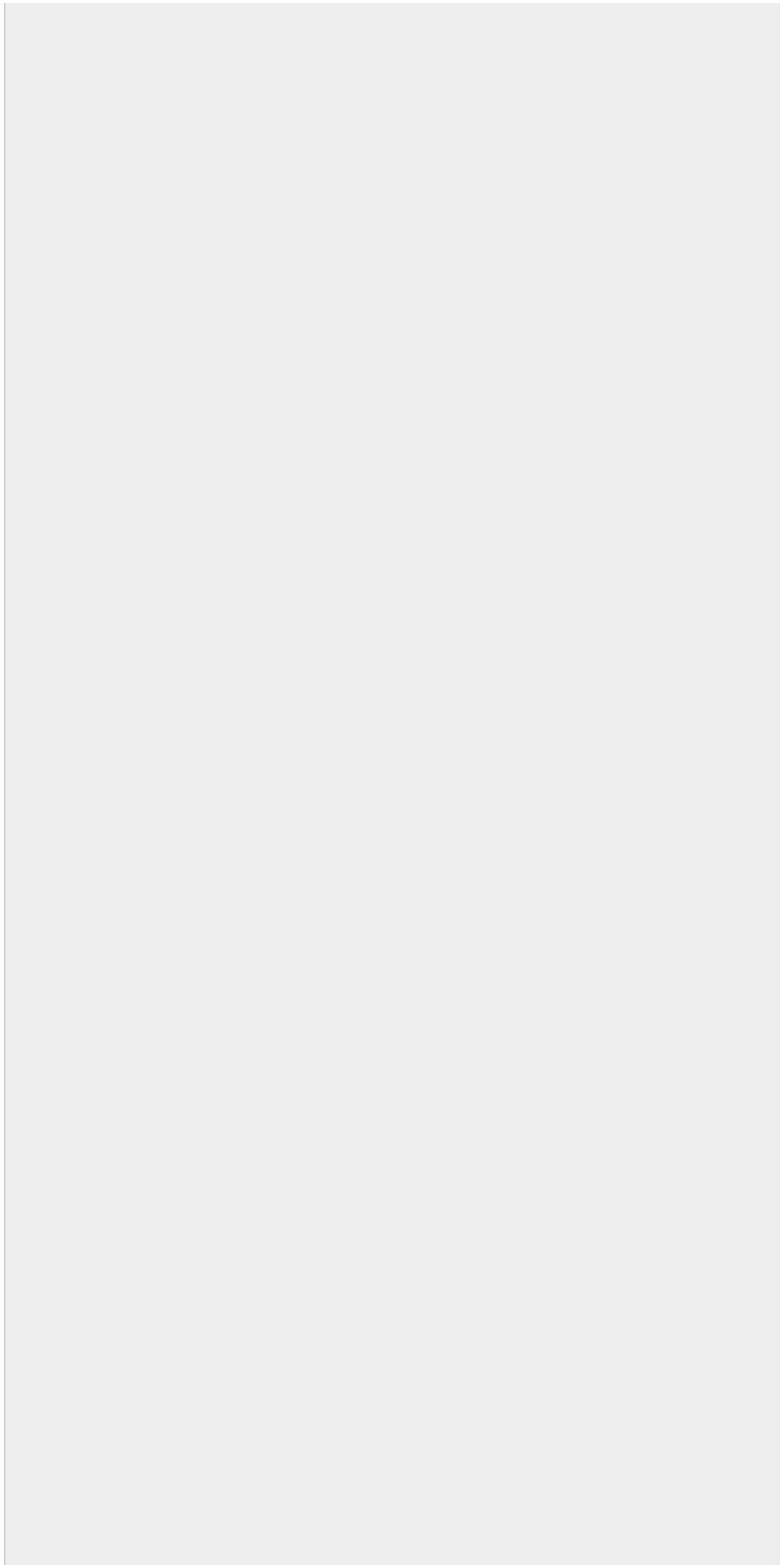
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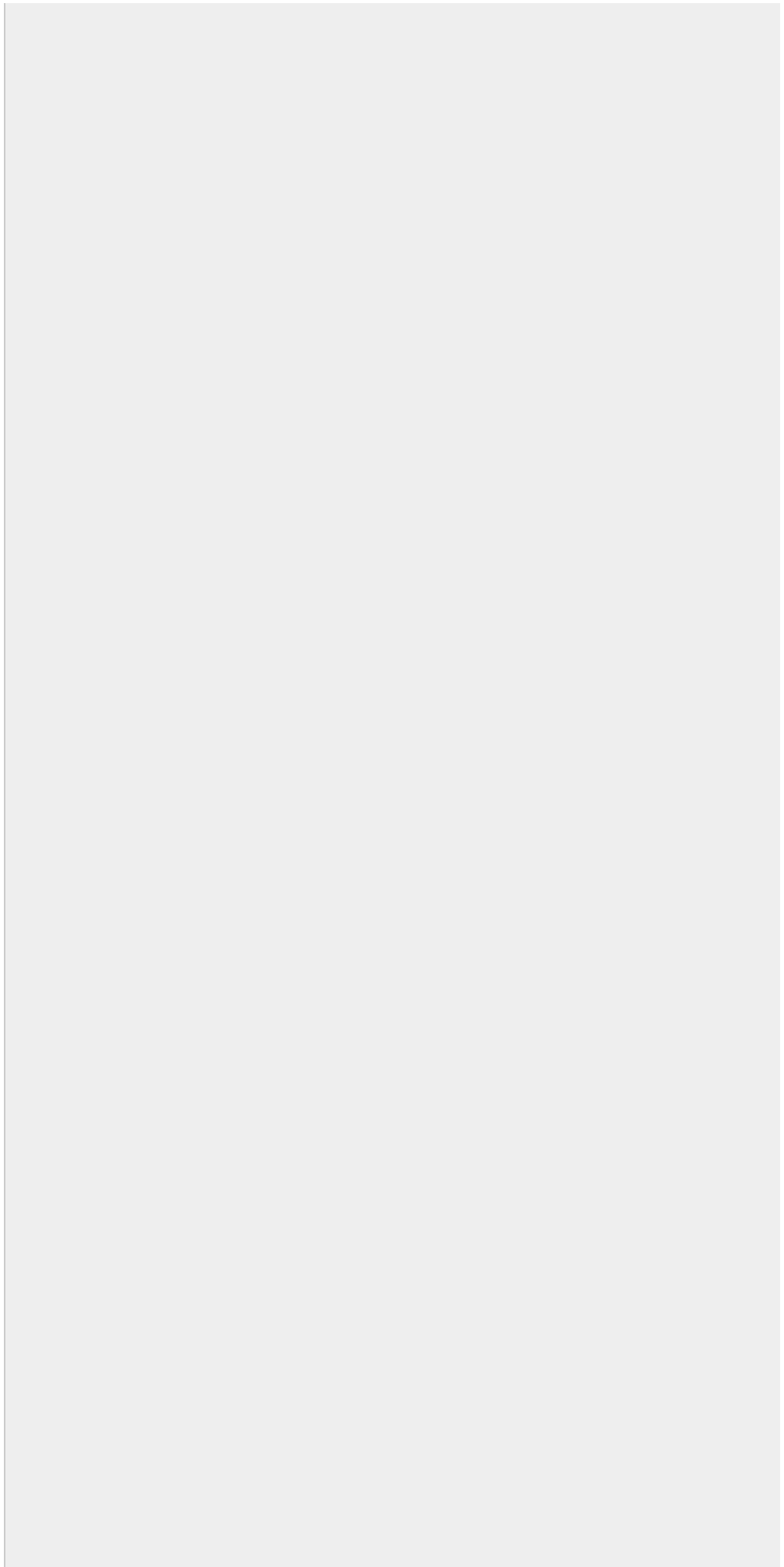
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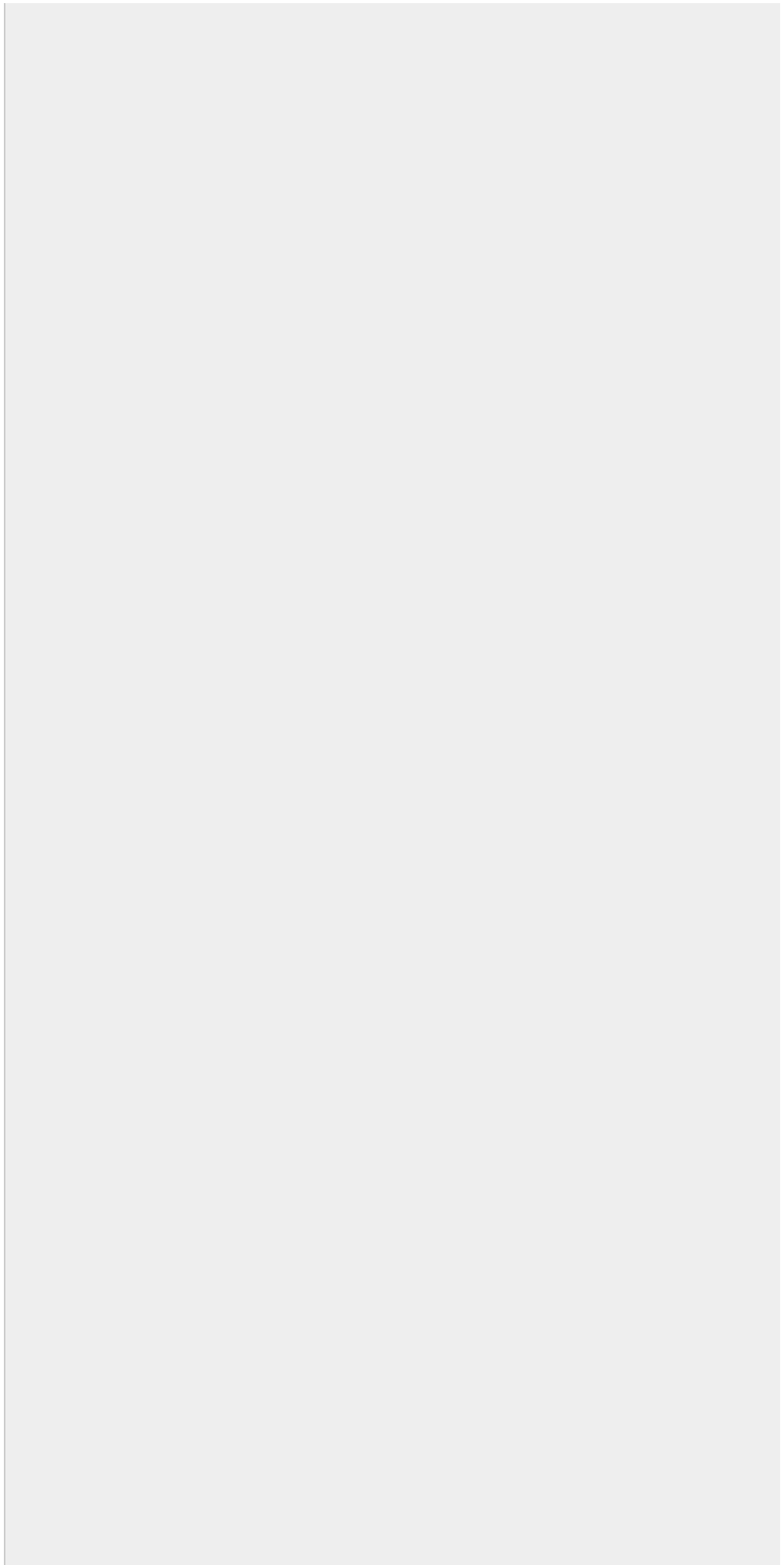


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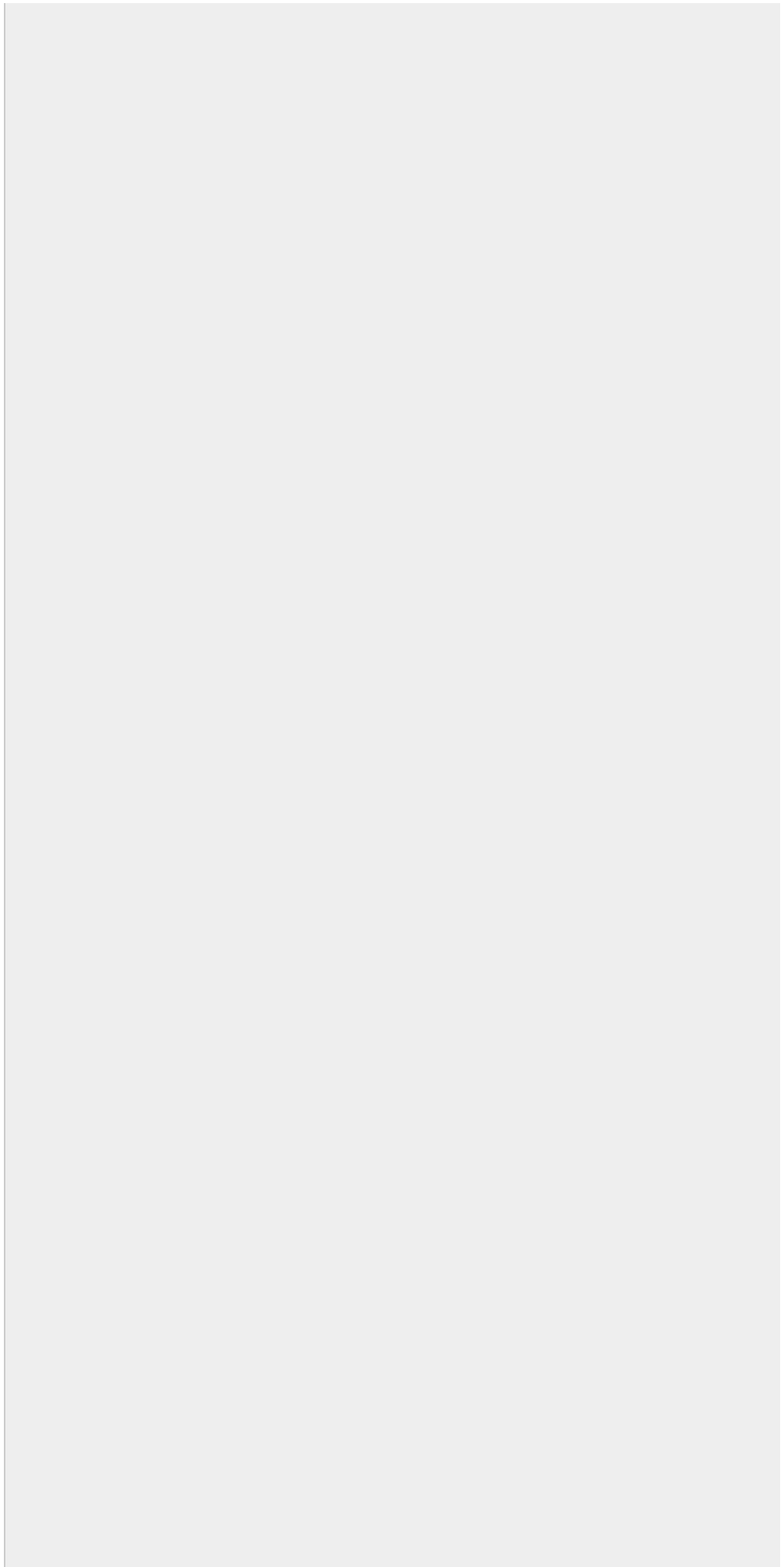




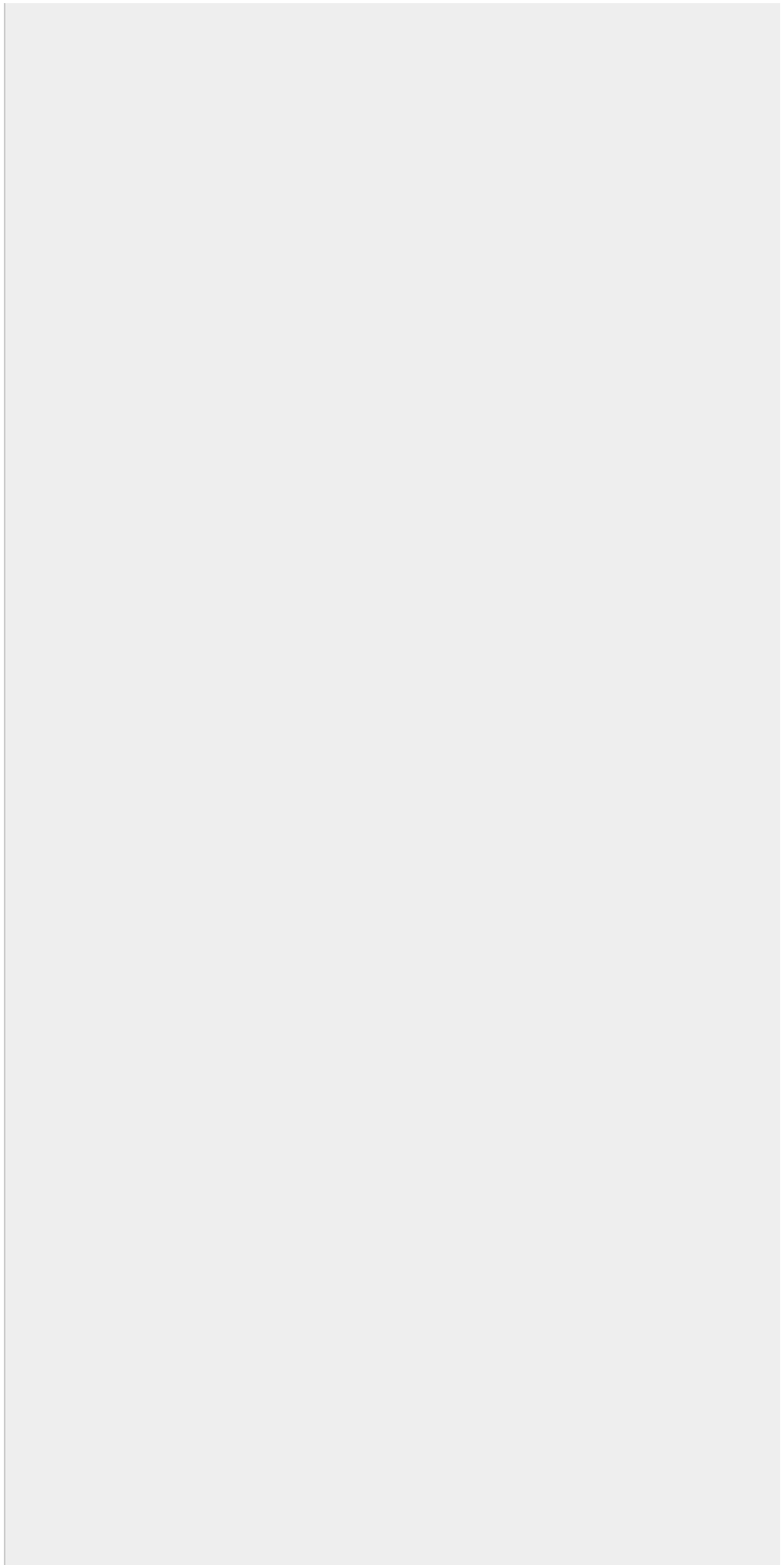
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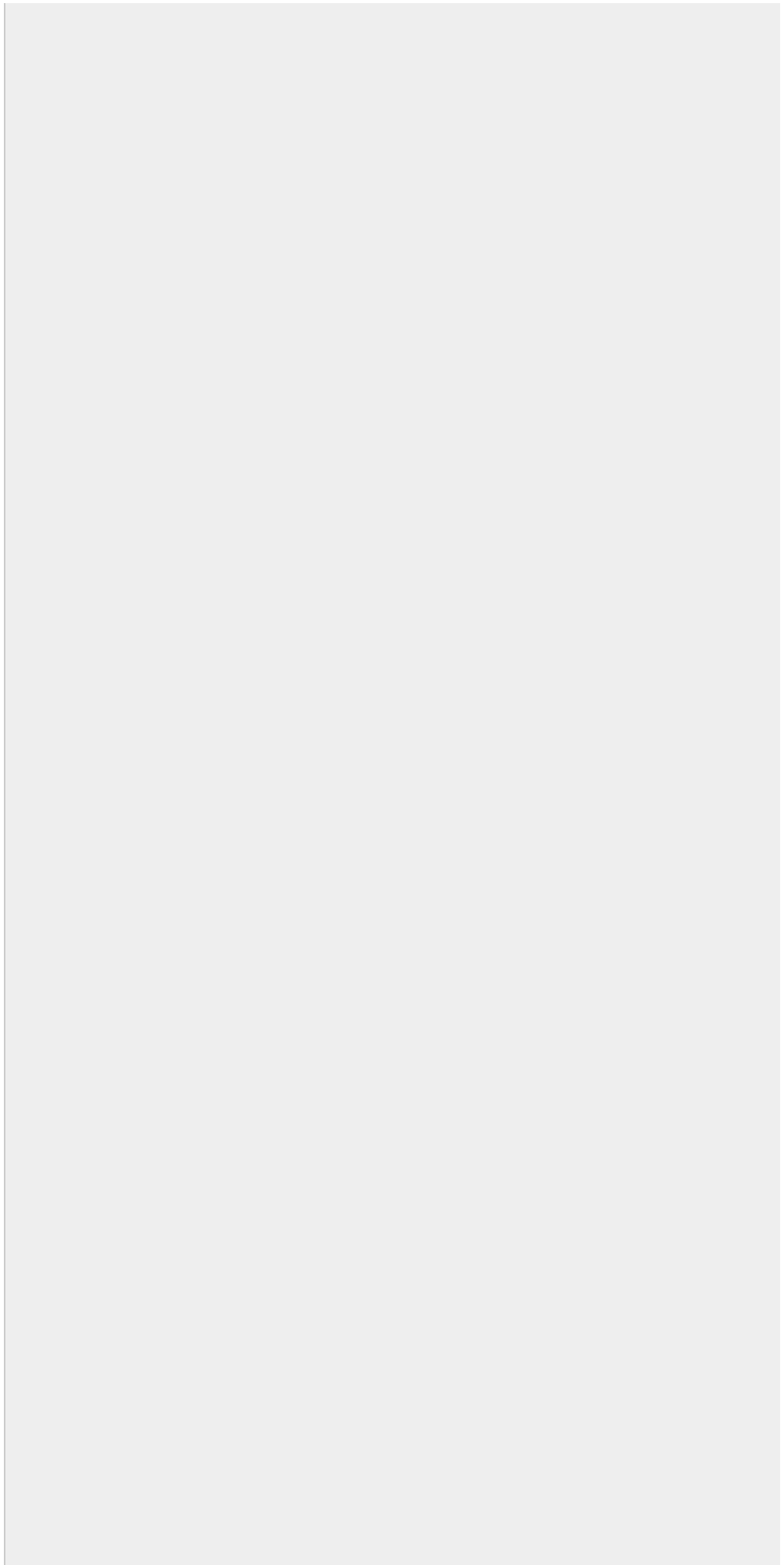
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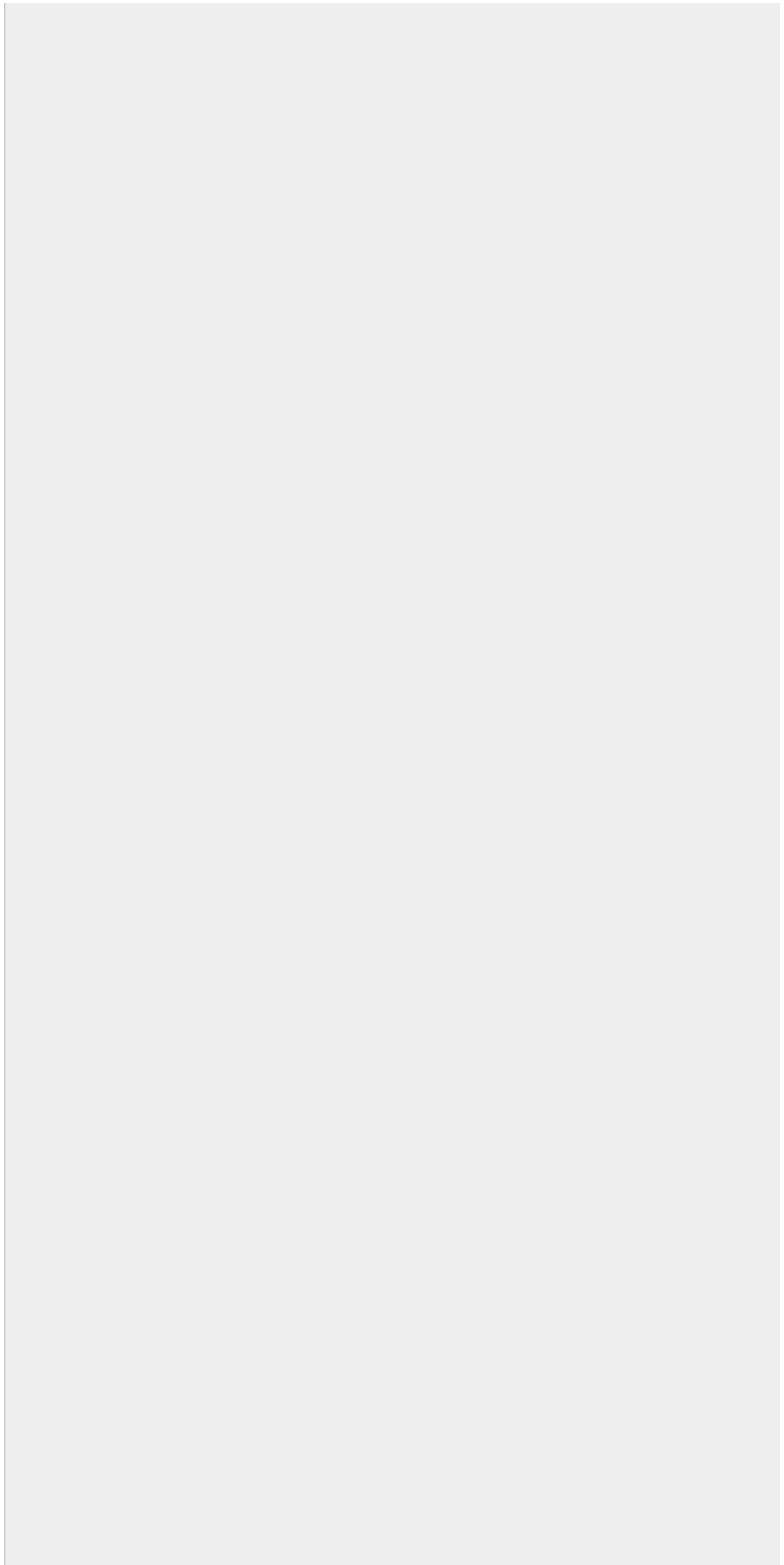
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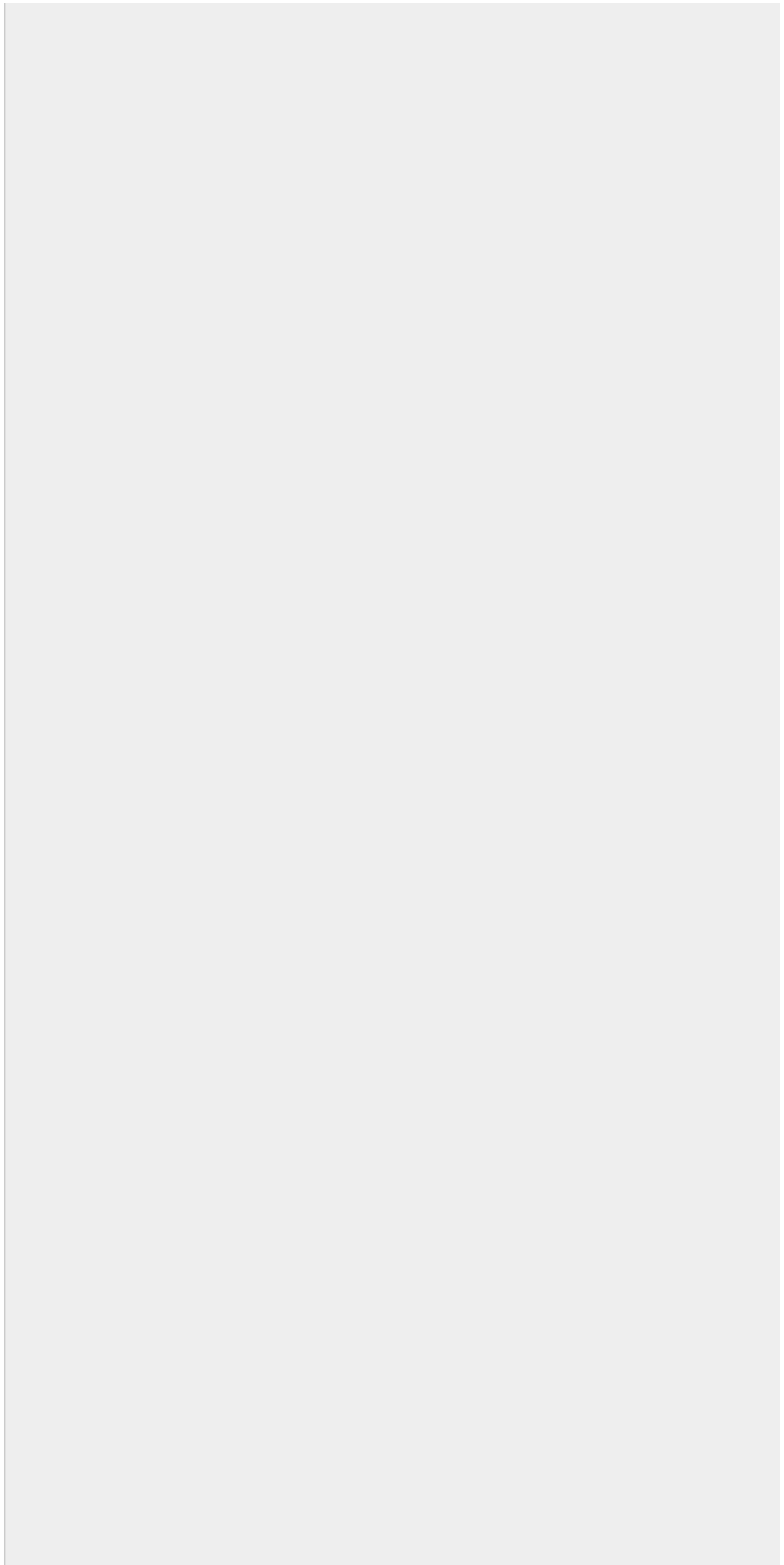
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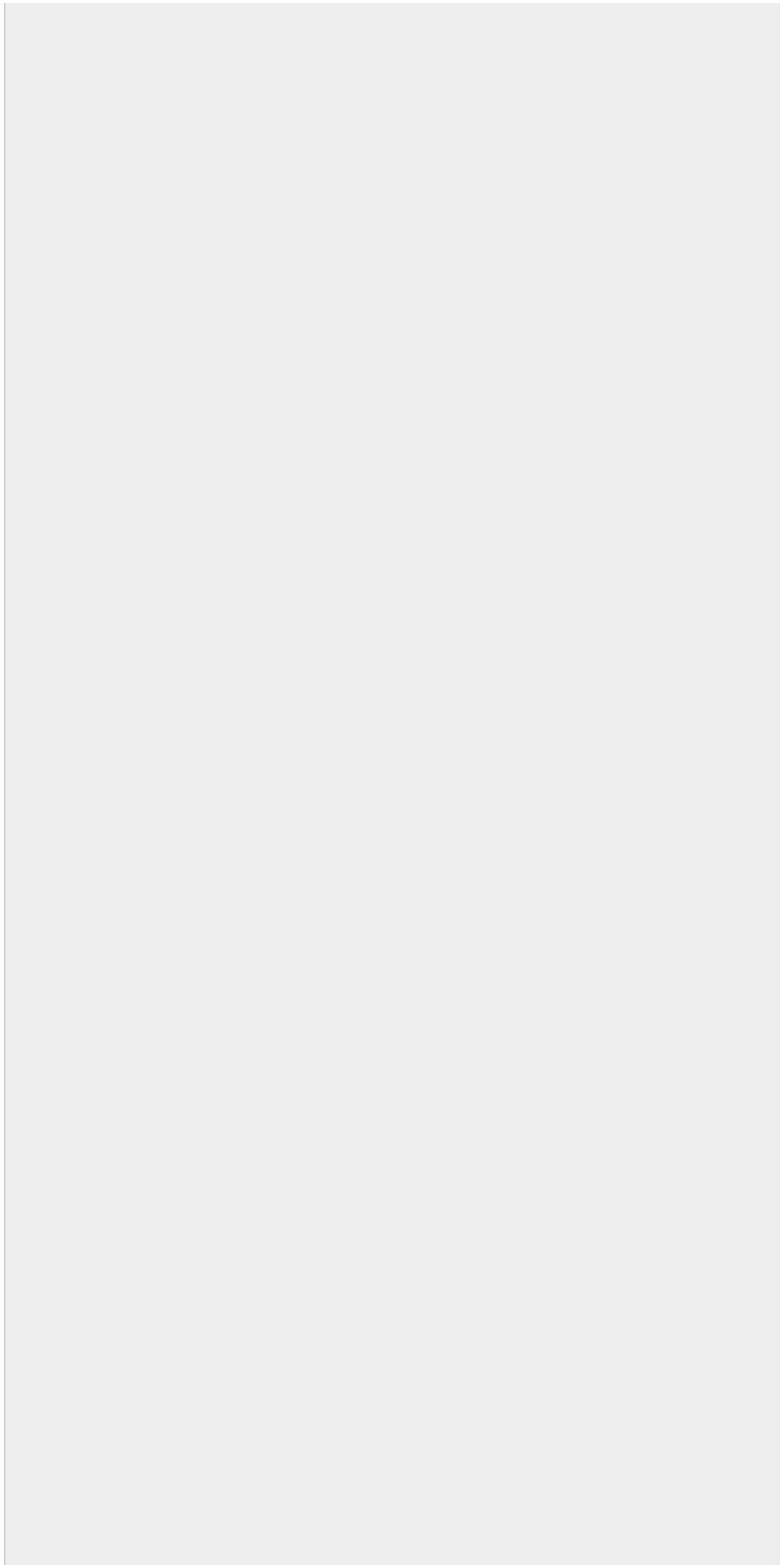
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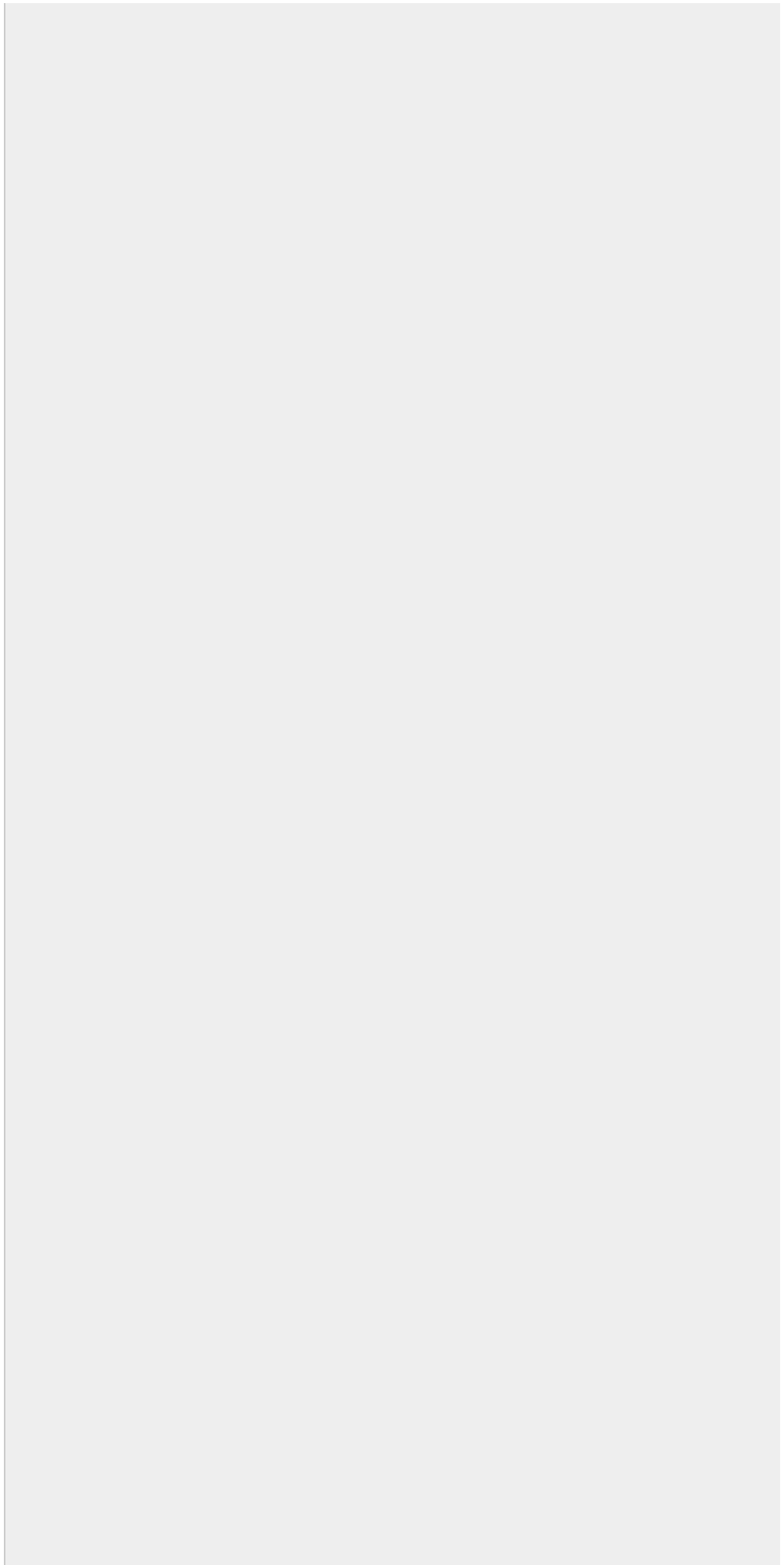
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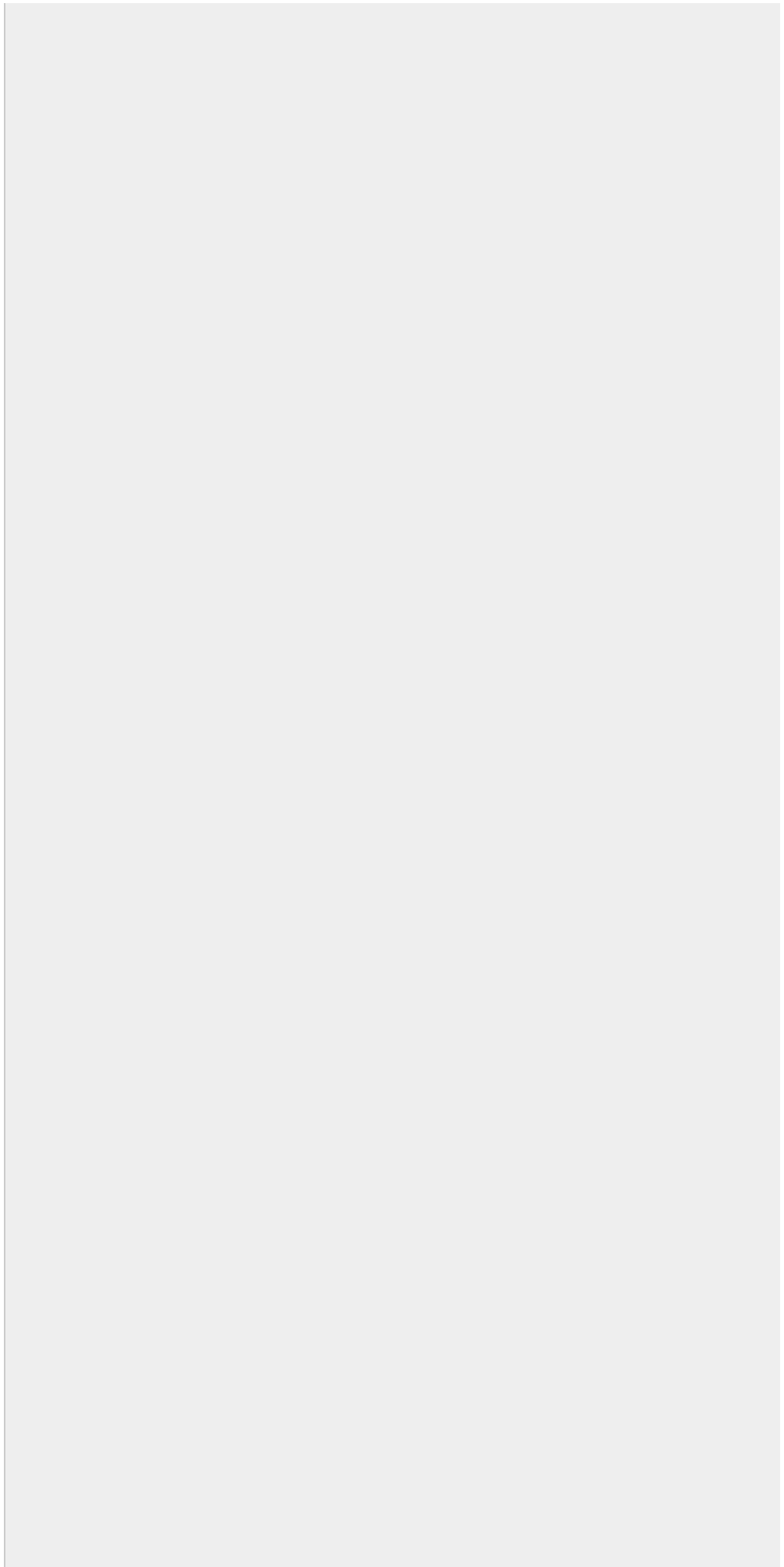


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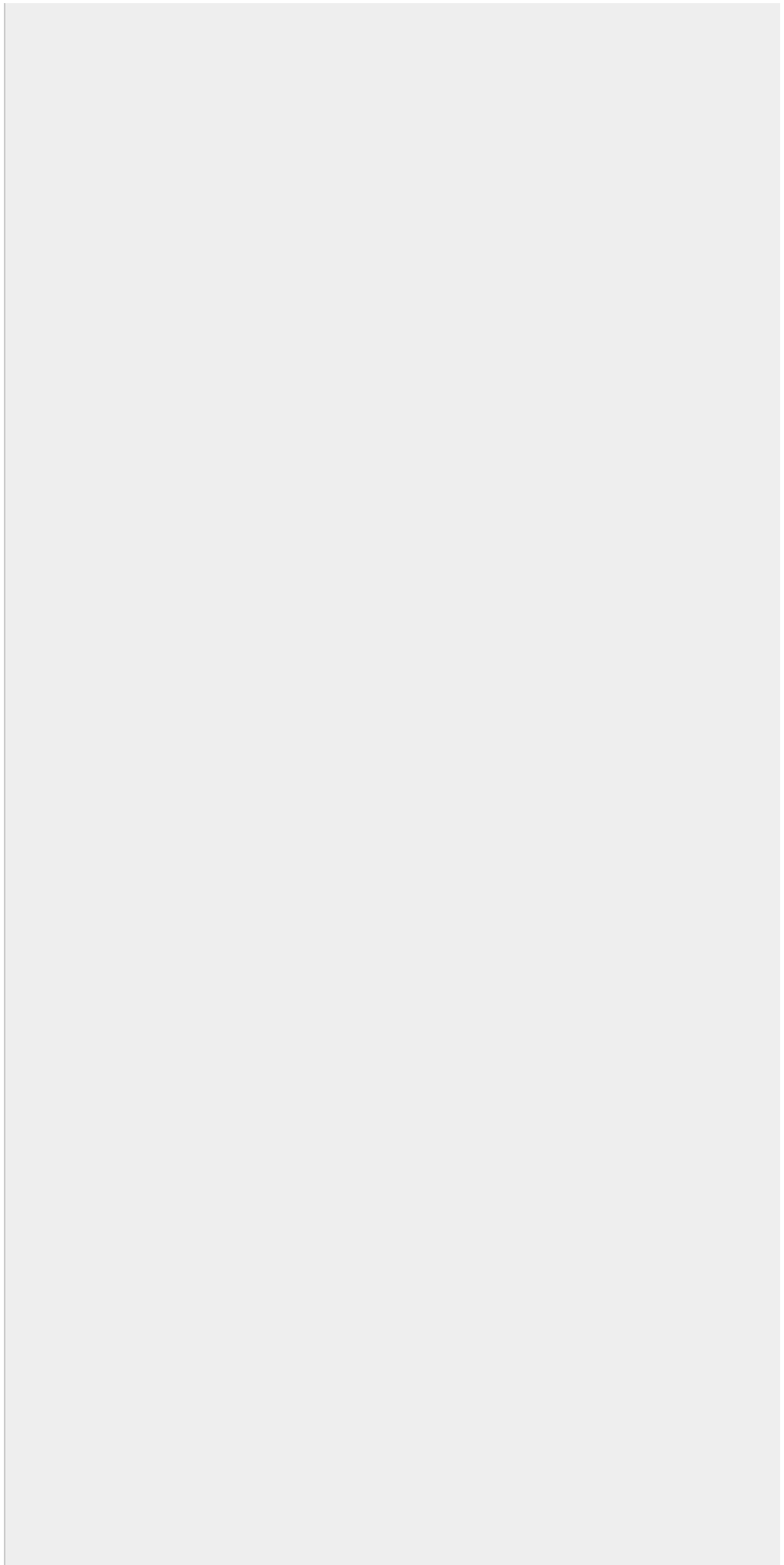




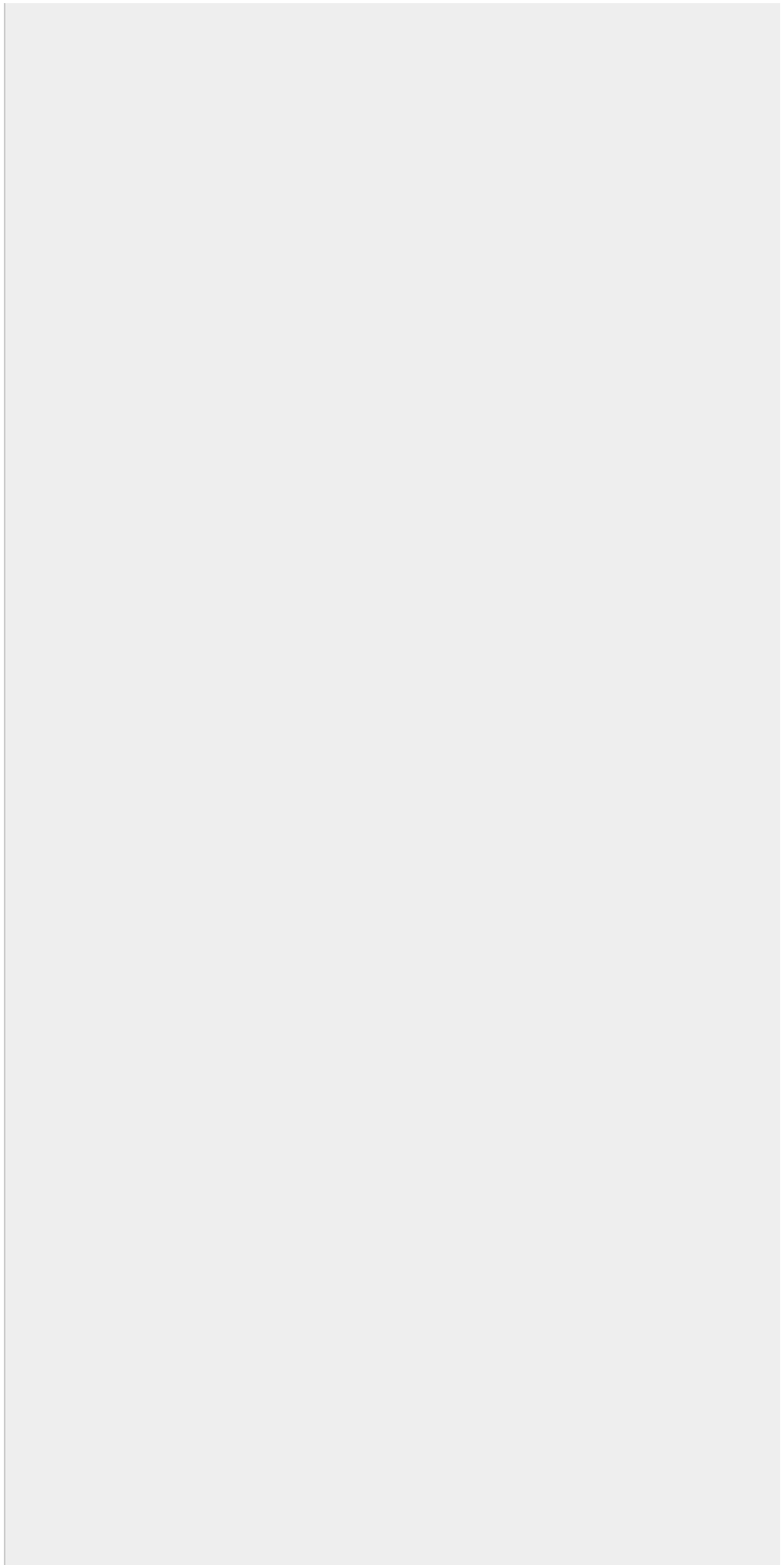
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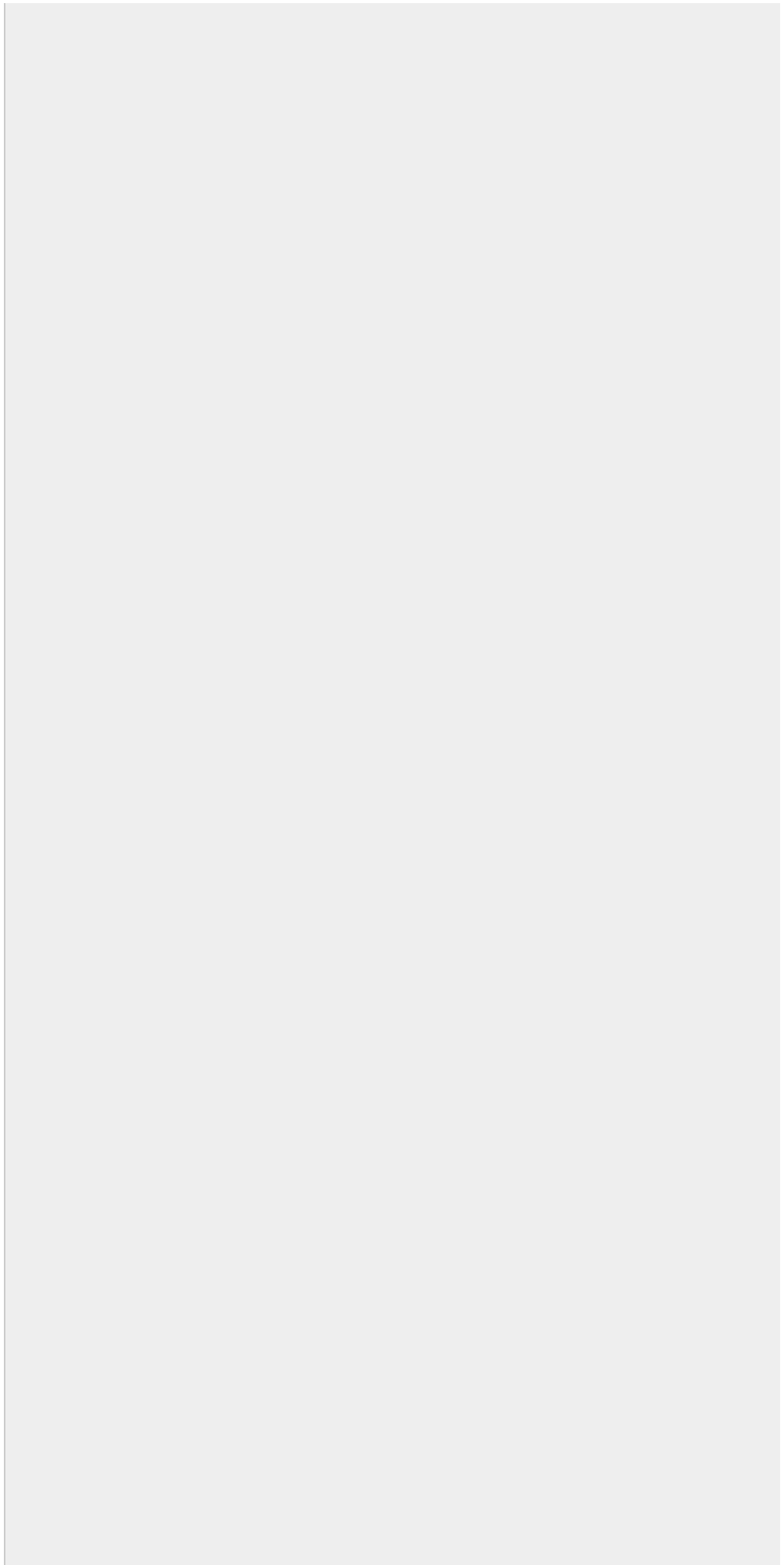
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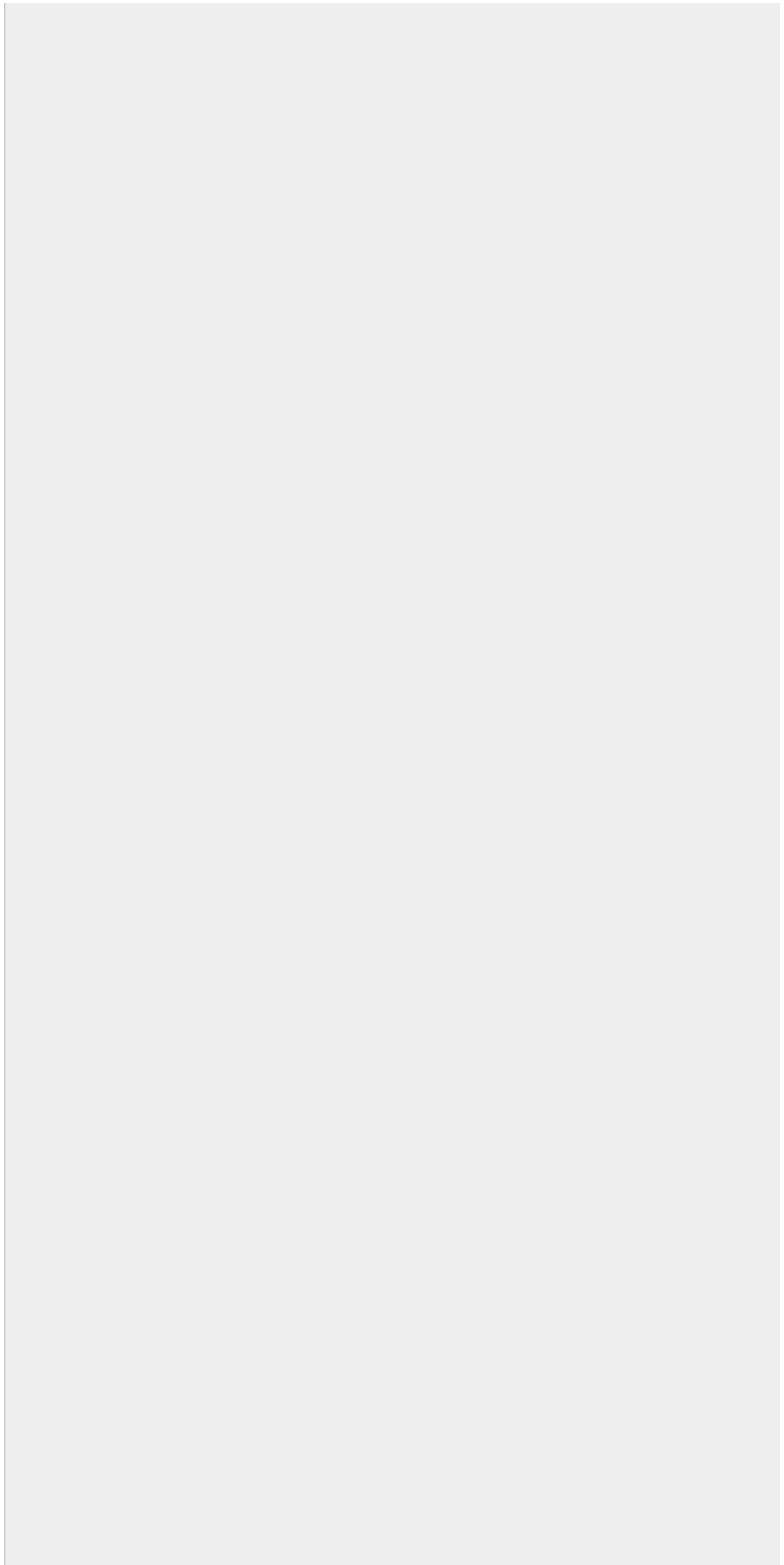
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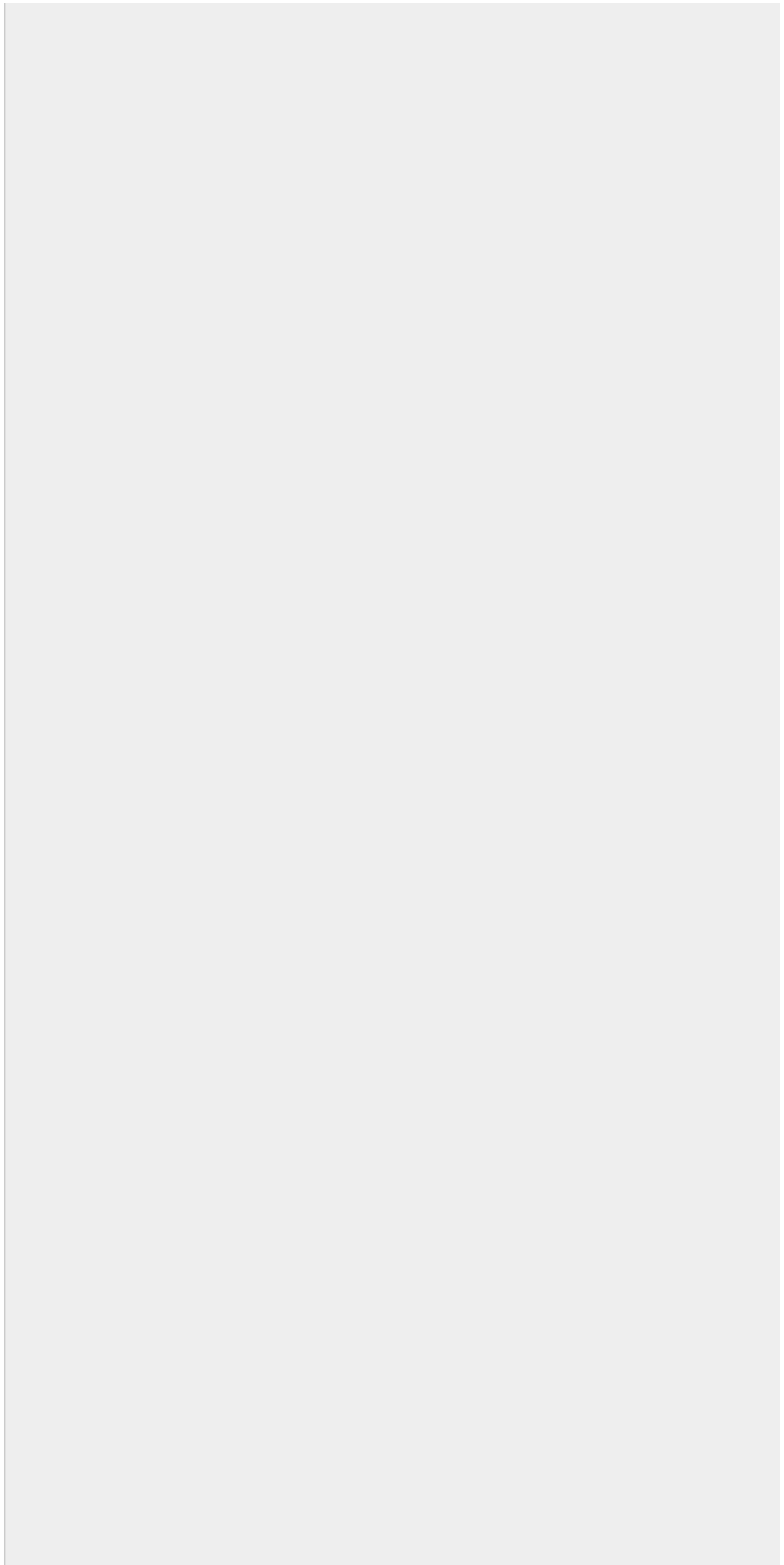
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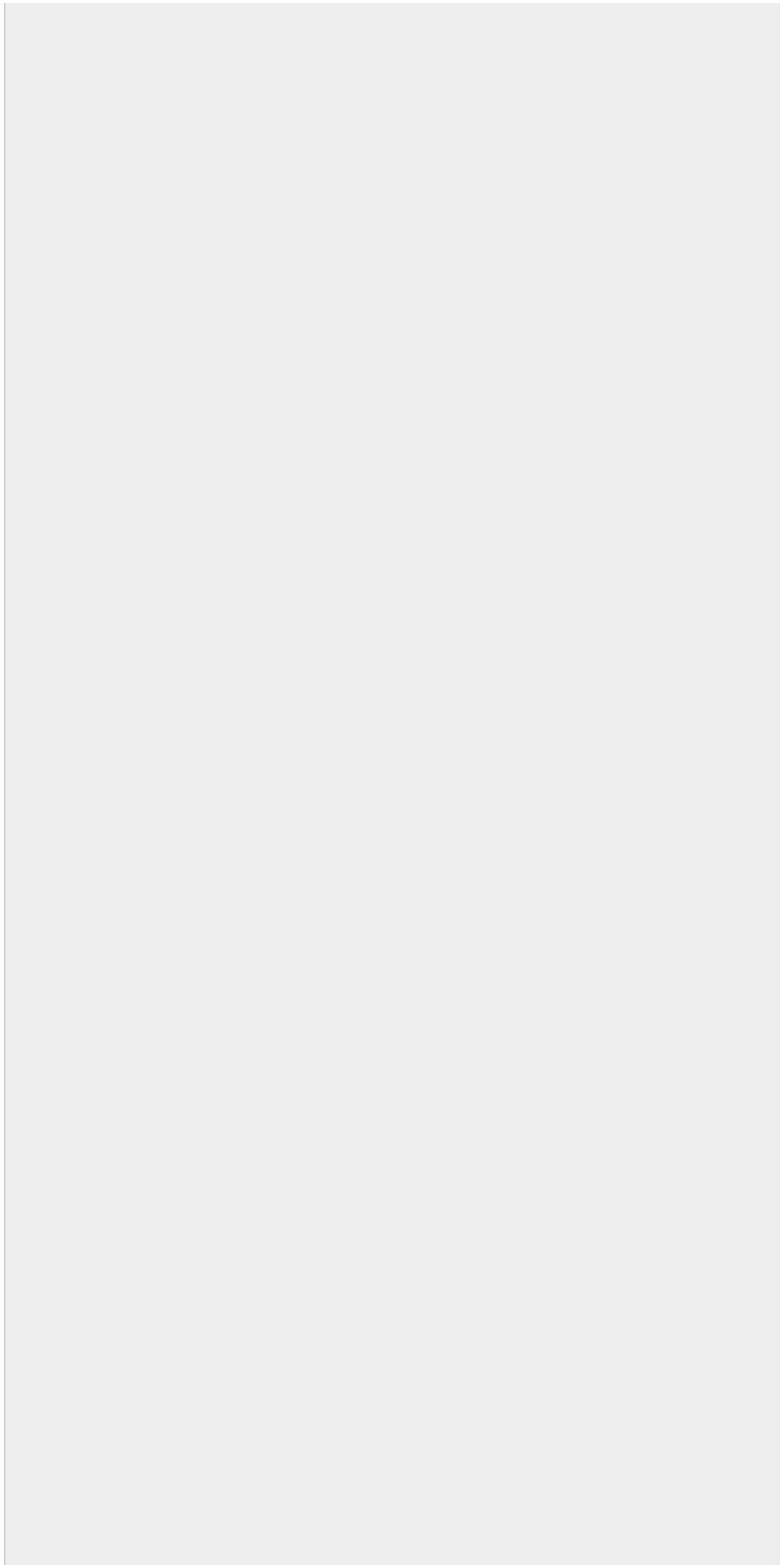
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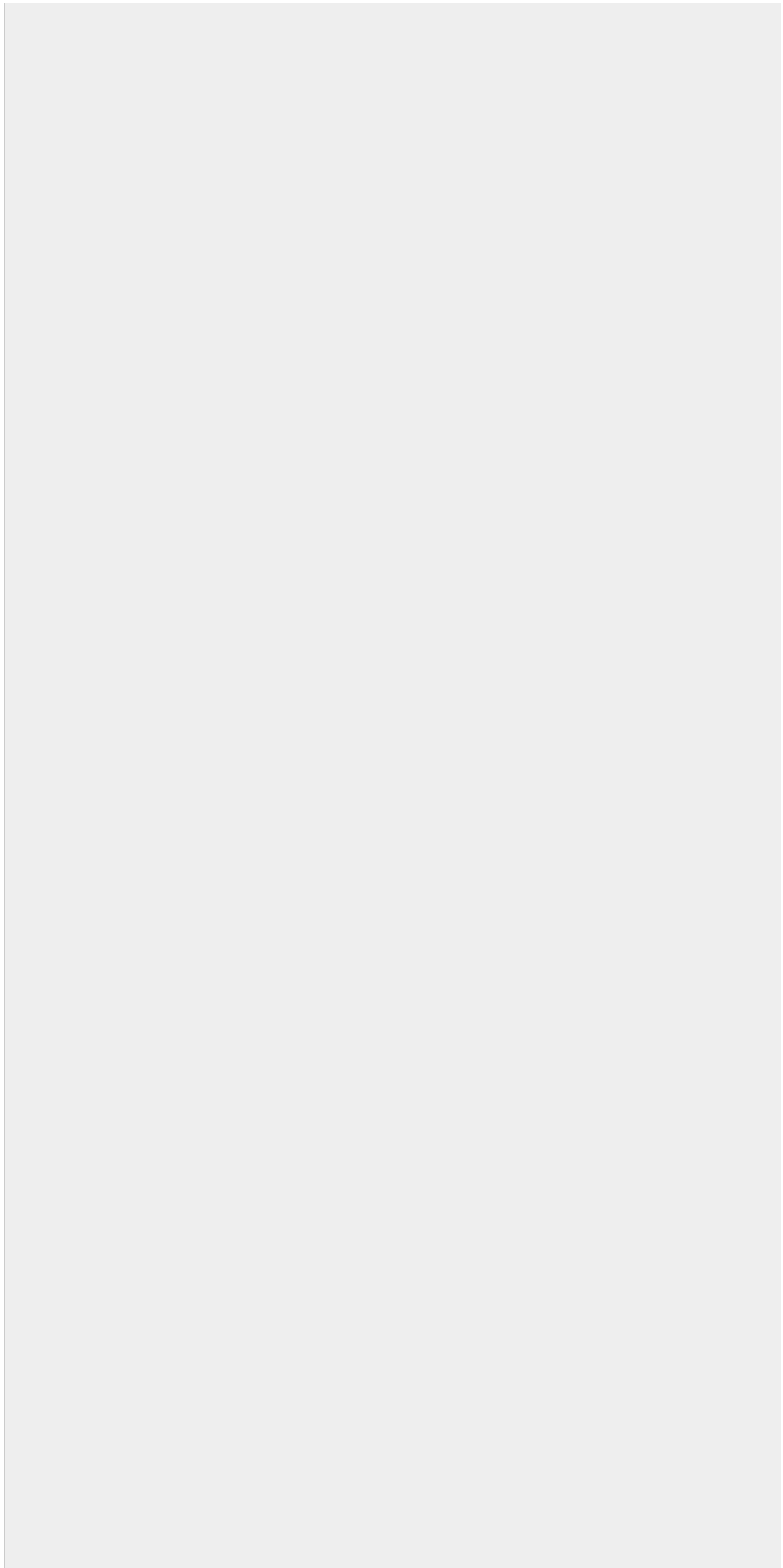
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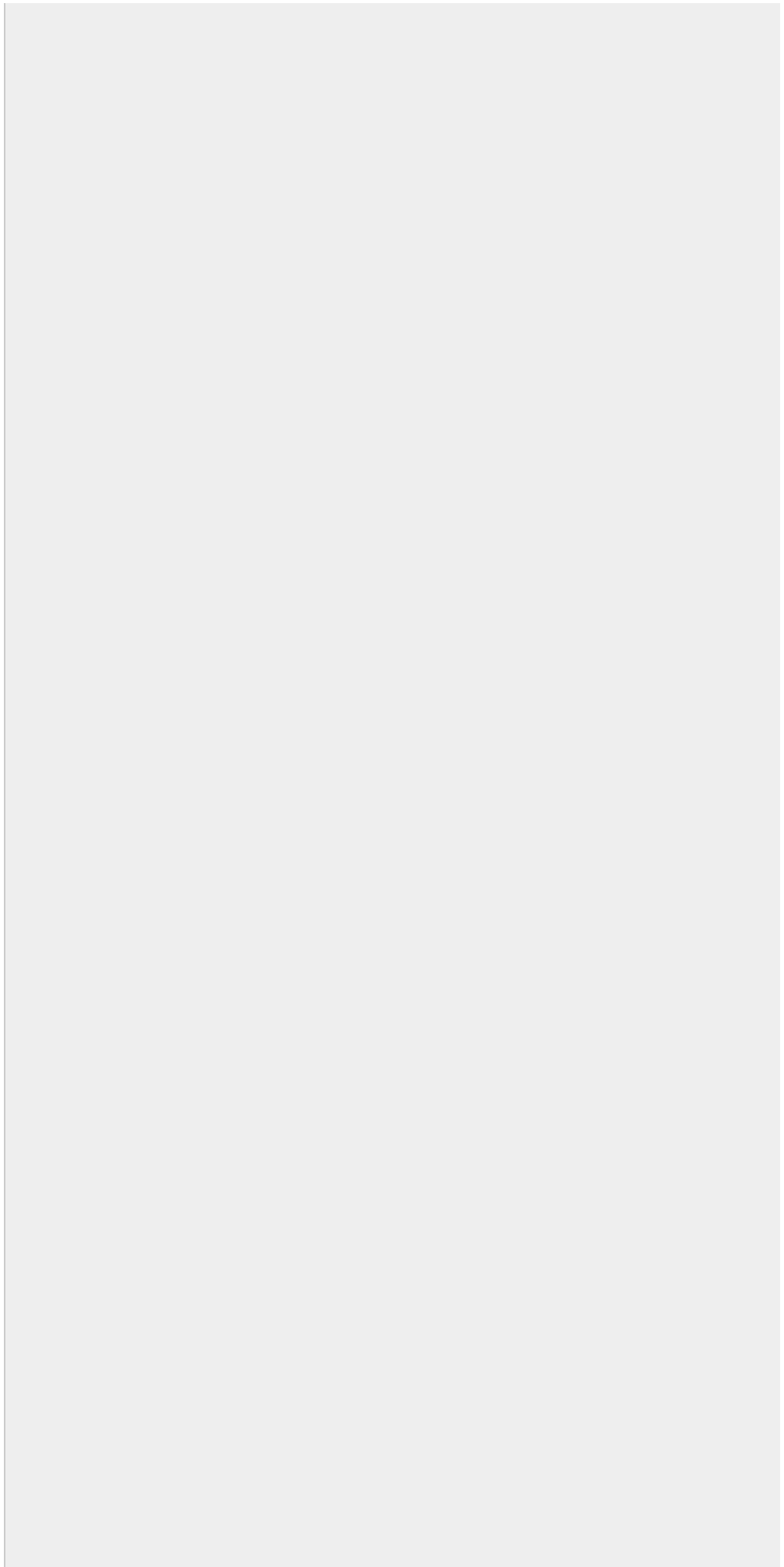


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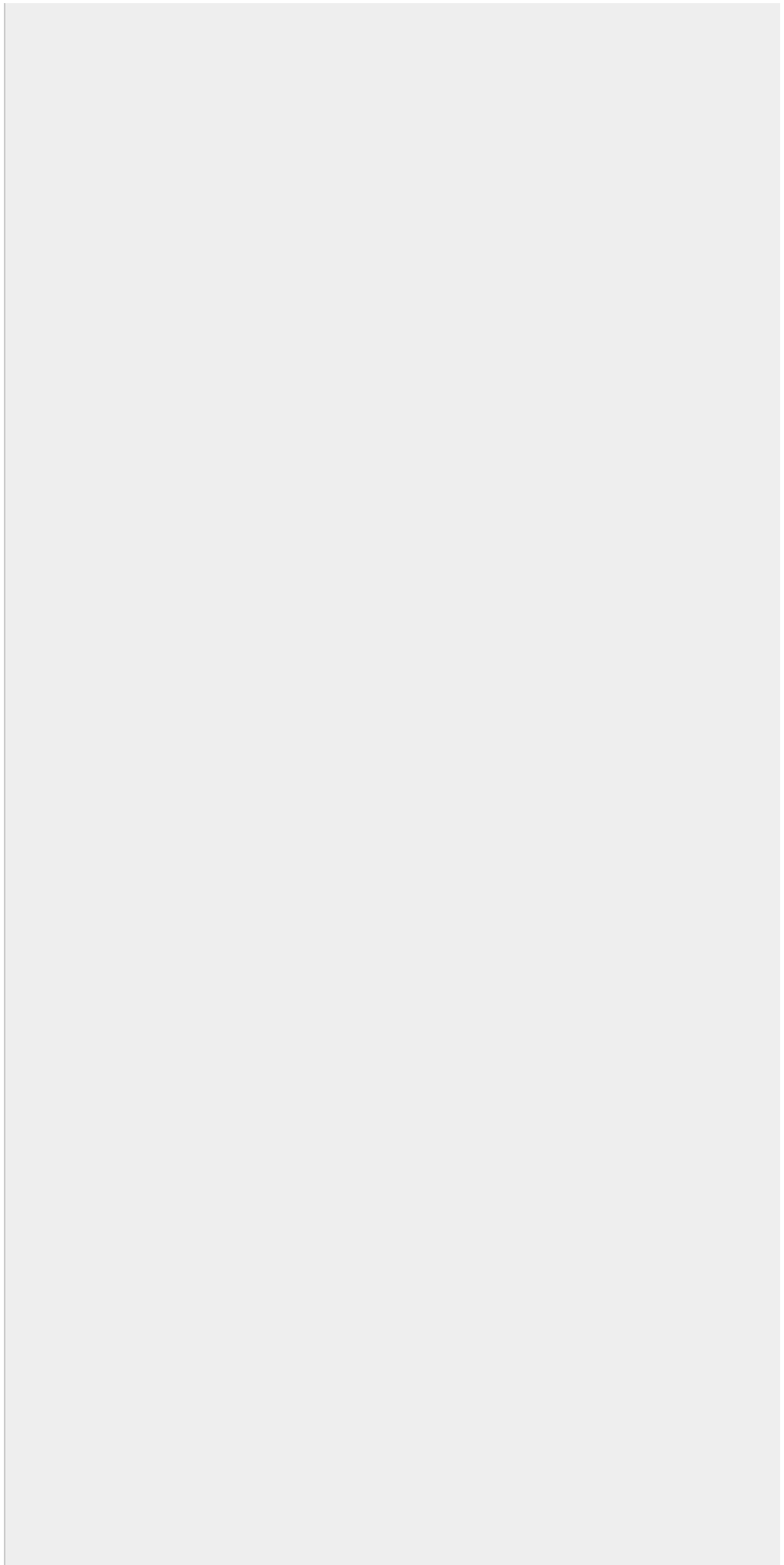




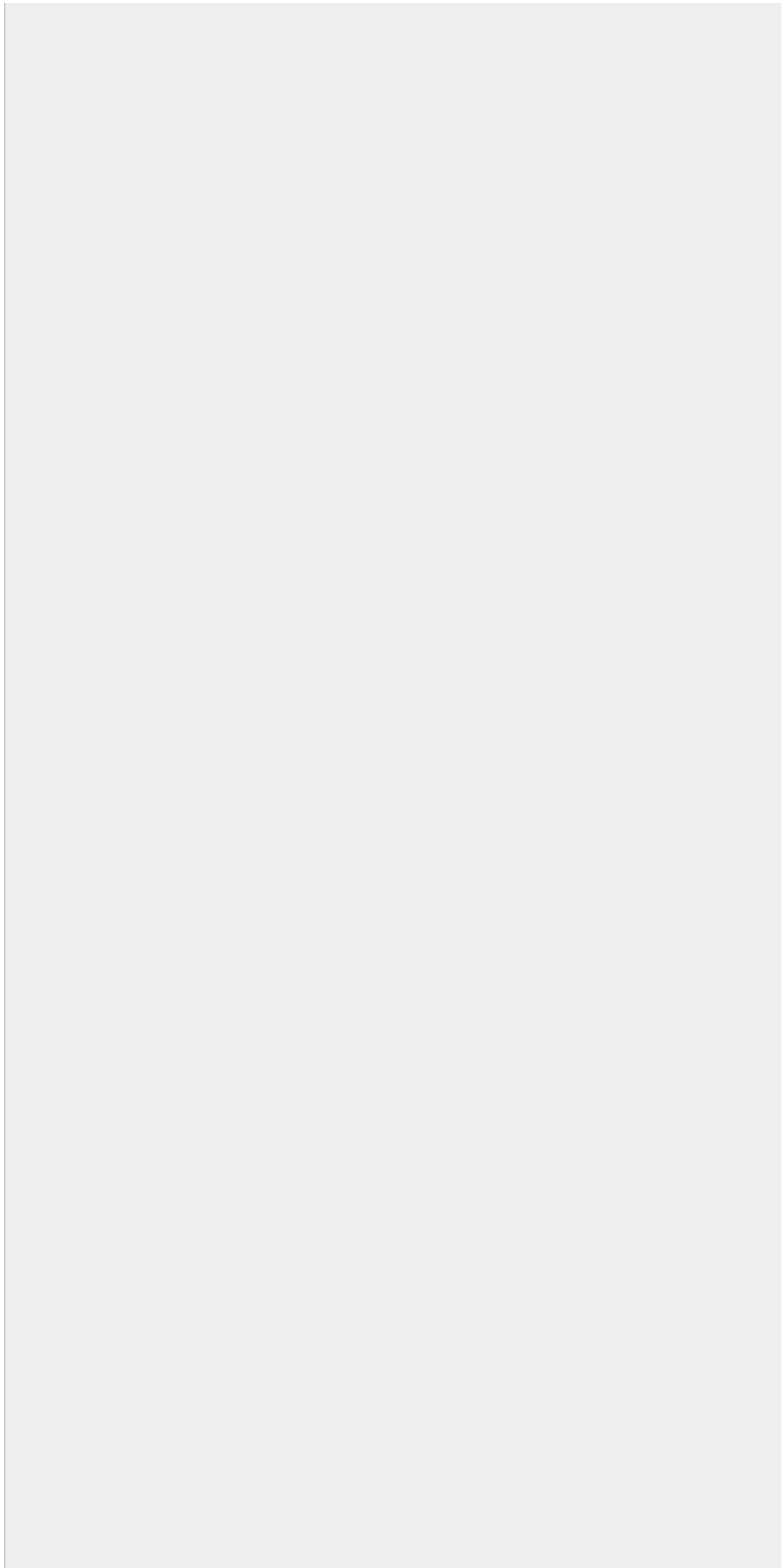
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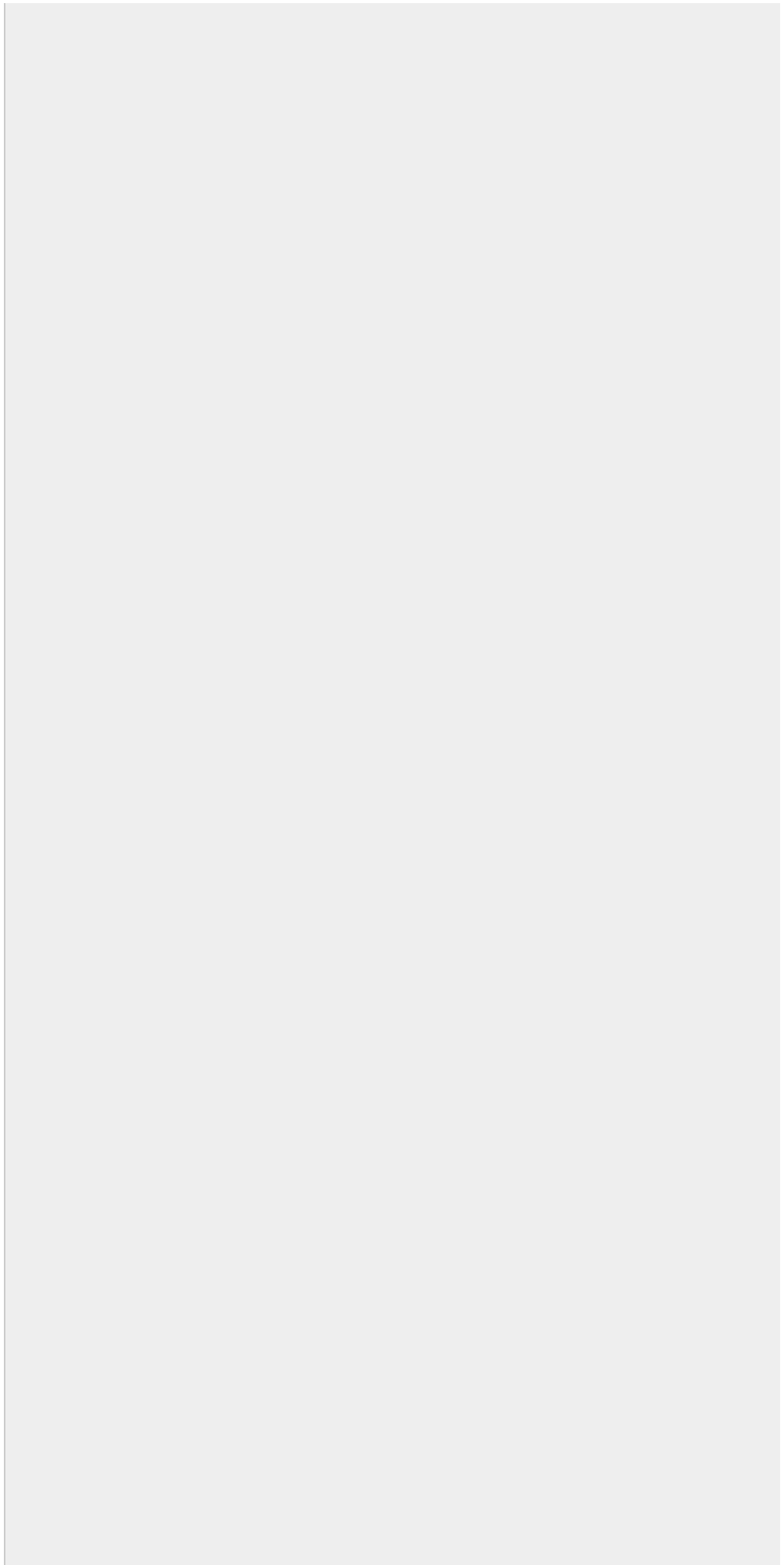
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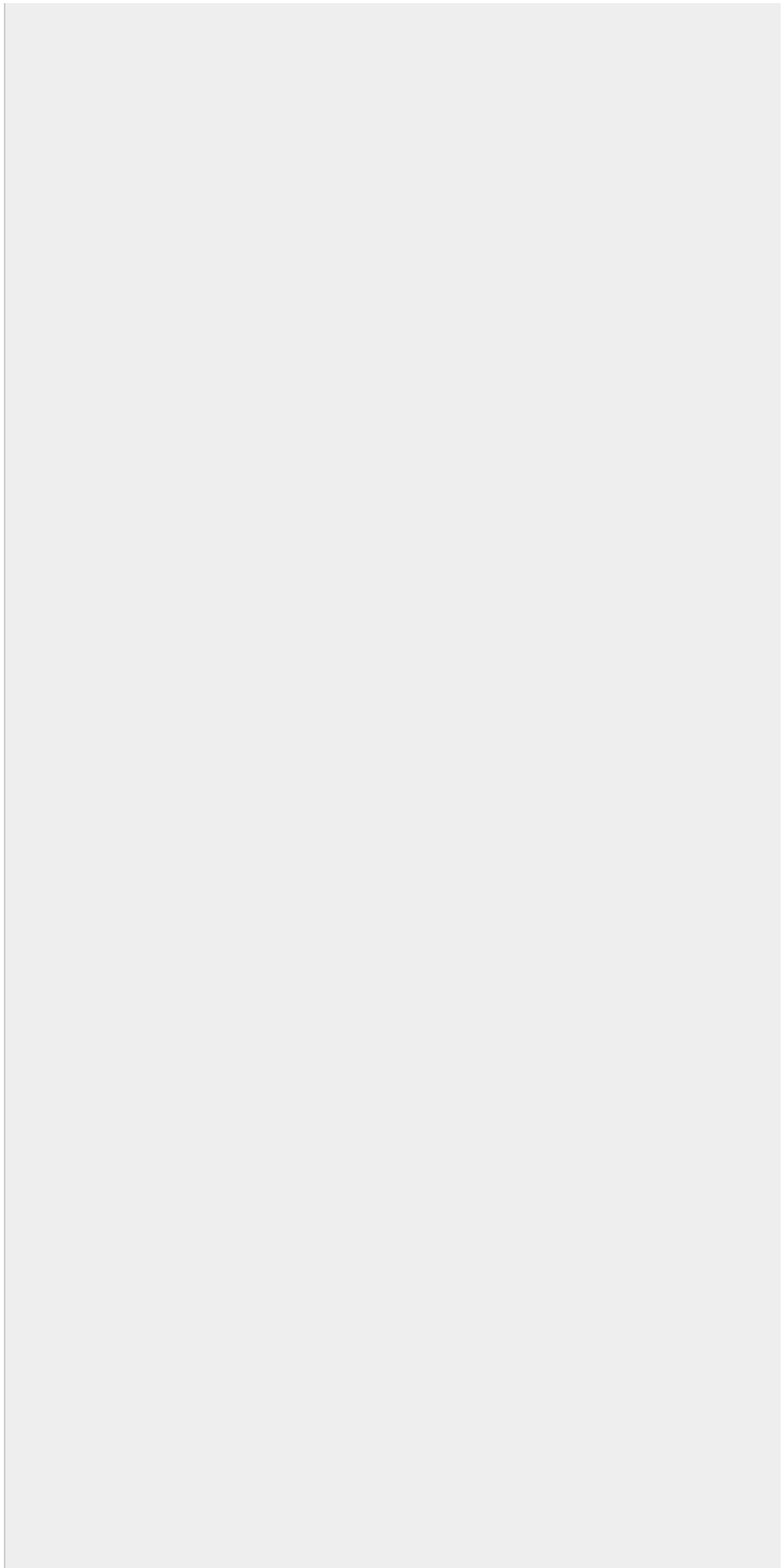
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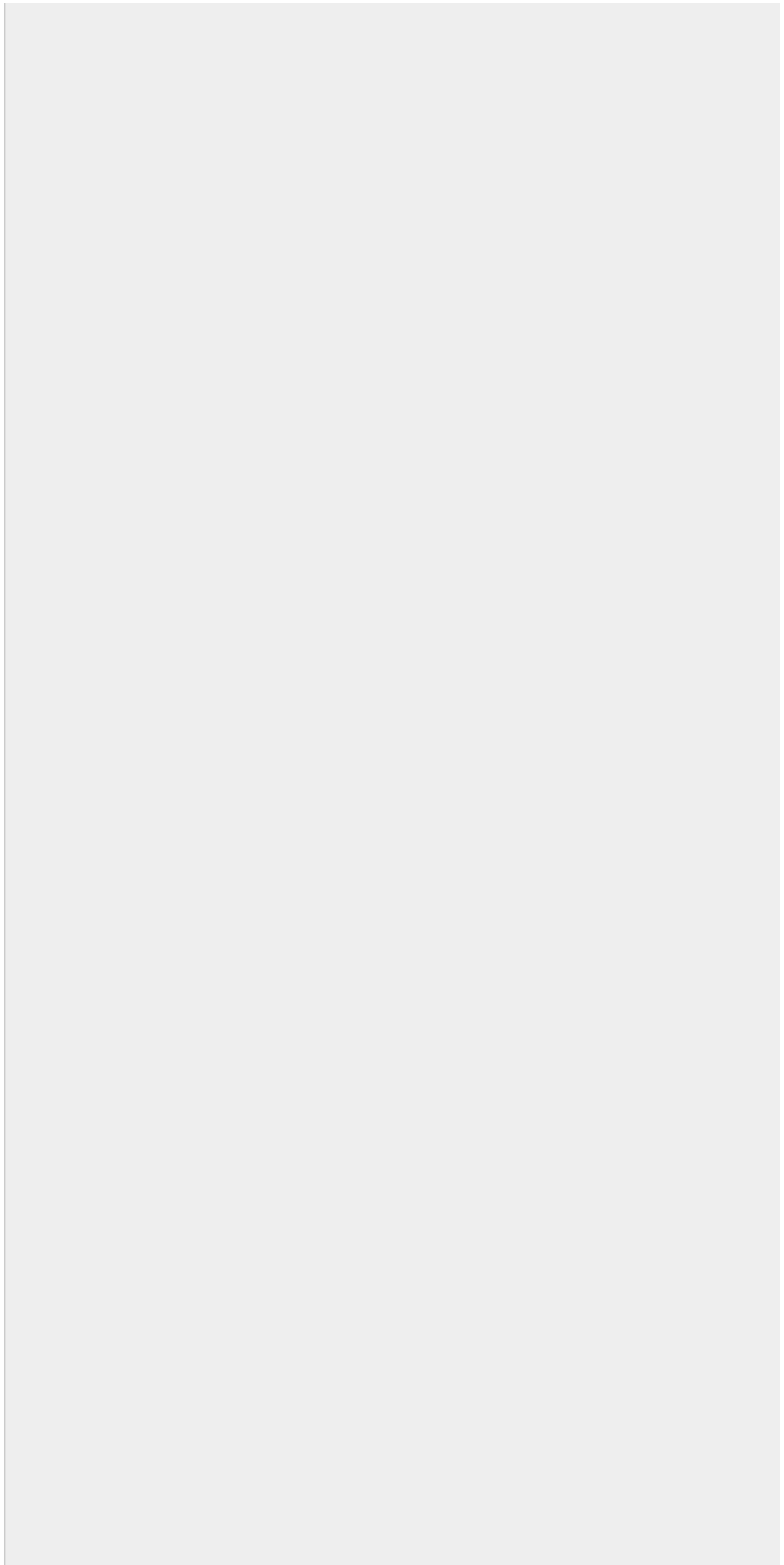
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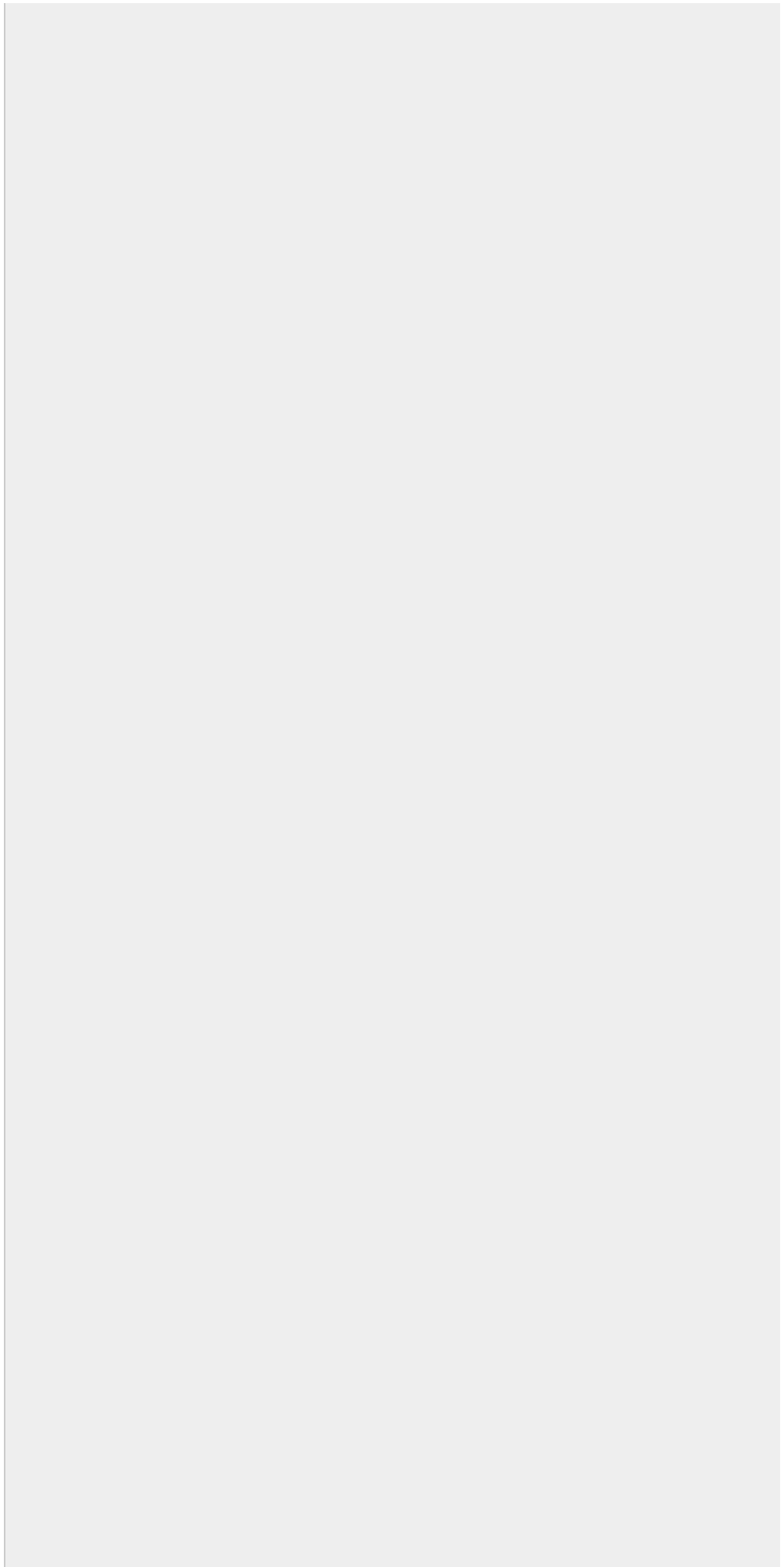
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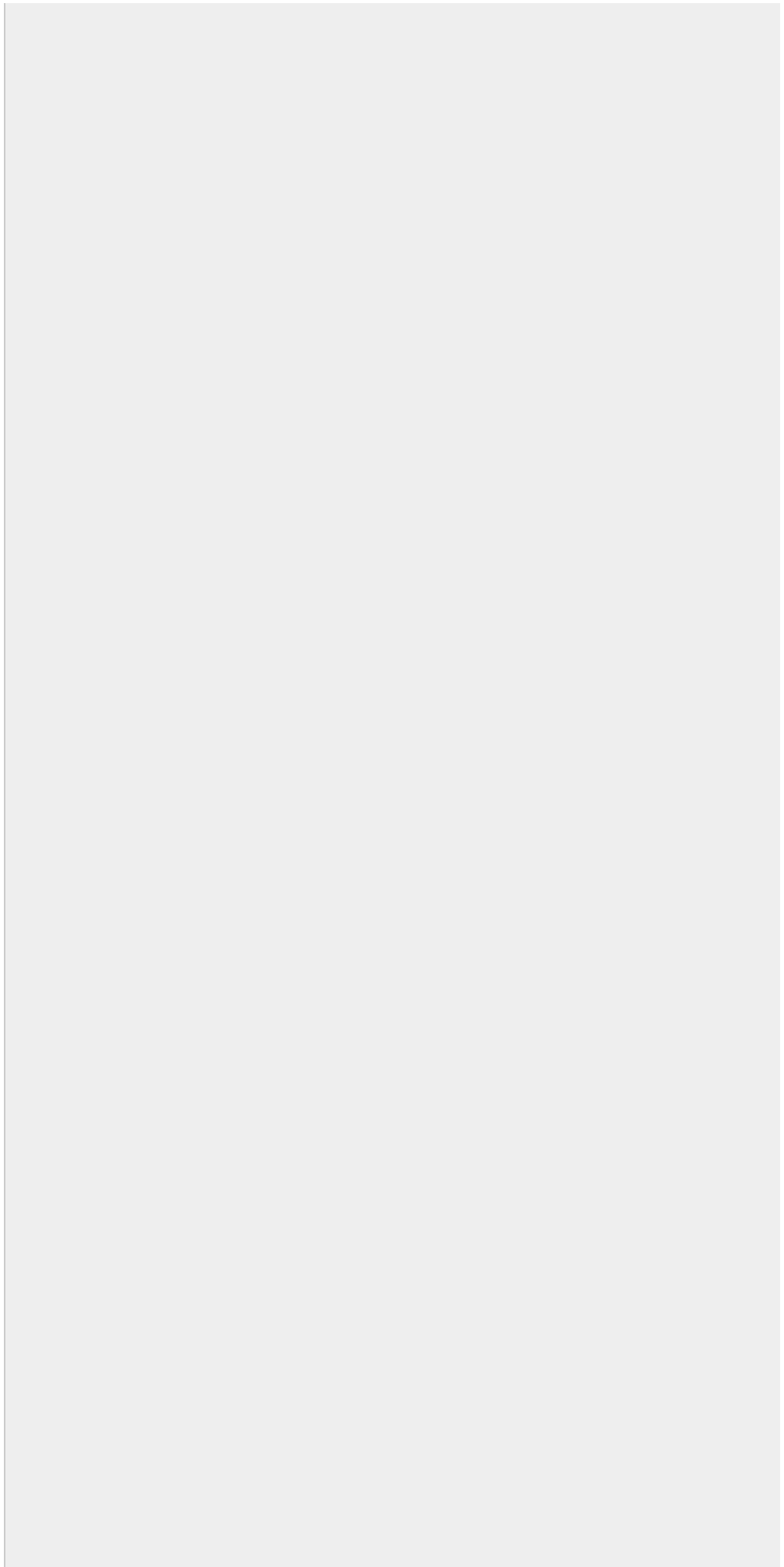
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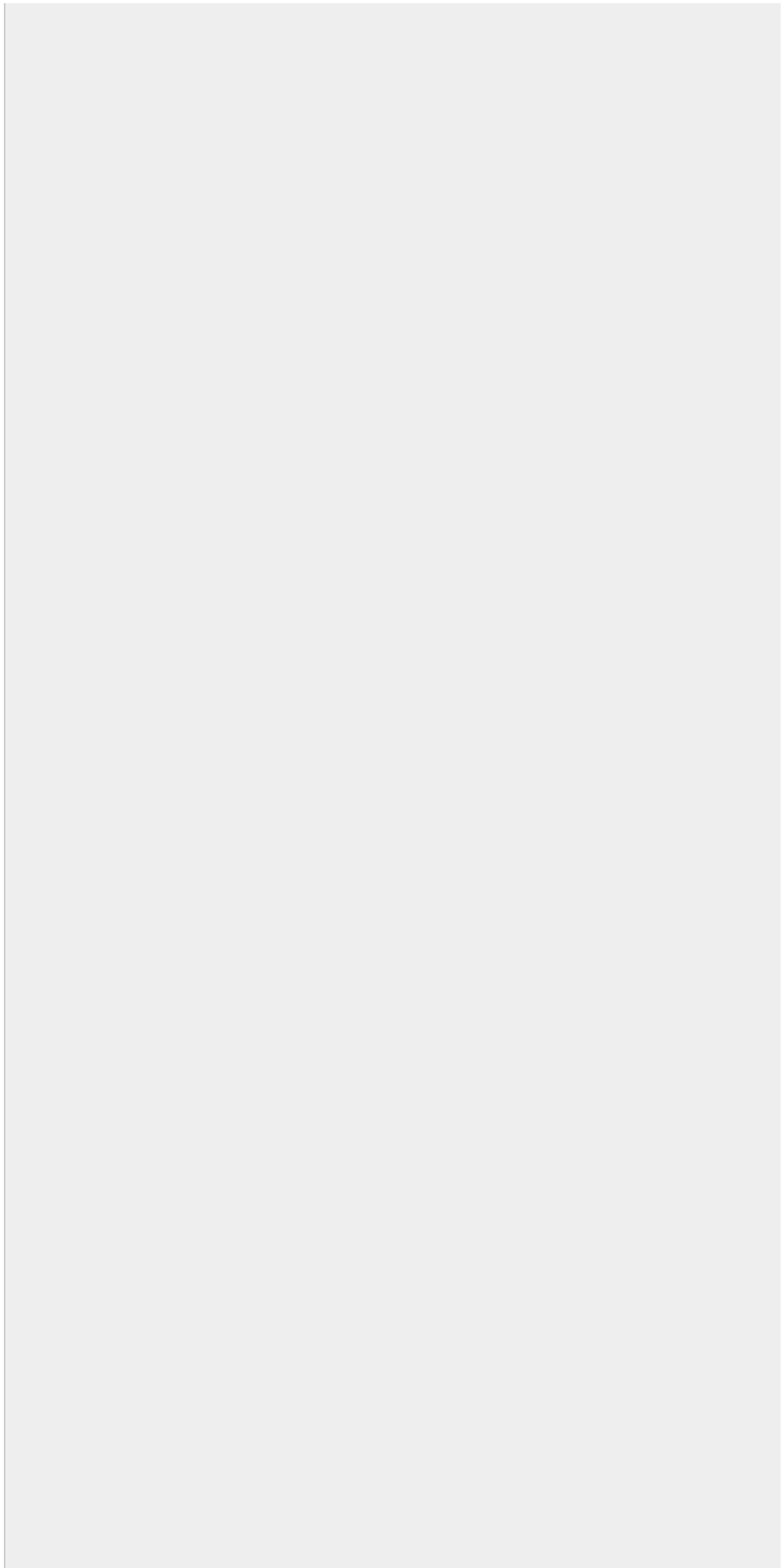


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# Anticancer potential of holothurin A, holothurin B, and holothurin B3 from the sea cucumber *Holothuria scabra*

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Teresa Liliana Wargasetia, Hana Ratnawati, and Nashi Widodo



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# Anticancer Potential of Holothurin A, Holothurin B, and Holothurin B3 from the Sea Cucumber *Holothuria scabra*

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**Abstract.** Sea cucumbers have a wide distribution and high abundance in Indonesia. Previous research has shown that sea cucumbers have an anticancer function and have toxicity to various types of cancer cells. Furthermore, we identified the anticancer compounds of the sea cucumber *Holothuria scabra* collected from the South Malang sea. *H. scabra* was extracted using methanol, and then the active compound content was analyzed using liquid chromatography-mass spectrometry (LC-MS). From the results of the analysis, it is known that the methanol extract of *H. scabra* contains three types of anticancer compounds, namely holothurin A, holothurin B, and holothurin B3. Based on *in silico* analysis, it is estimated that the holothurin compounds have target proteins, namely BCL2, HDAC1, and PTPN2, which play an essential role in the process of apoptosis, cell cycle, and suppressing tumor. The results of this study show that sea cucumber might have anticancer, although various *in vitro* and *in vivo* tests are needed to prove the anticancer mechanism.

## INTRODUCTION

Sea cucumbers (or holothurians) are soft-bodied echinoderms, shaped like cucumber with leathery skin and elongated body, habitually live on the lowest level of deep seas [1,2]. Some of them are consumed as nutritious food in some parts of Asia and have been long utilized in Asiatic folk medicine [1,3]. Sea cucumbers contain many valuable compounds for human's health such as vitamins (A, B1, B2, and B3), minerals (calcium, magnesium, zinc, and iron), chondroitin sulfates, fucoidan, glycosaminoglycans, glycoproteins, glycosphingolipids, lectins, non-glycosaminoglycan sulfated glycans, non-sulfated triterpene glycosides (variegatusides), peptides, sphingoid bases, triterpene glycosides (cucumariosides, Ds-echinoside, frondoside A, saponins, sti-choposides), and sterols [2,4].

Many studies have reported anticancer activity of bioactive compounds from sea cucumber through several molecular mechanisms in cancer cells such as cytotoxicity activity, induction of apoptosis, cell cycle arrest, reduction of tumor growth, antimetastatic, anti-angiogenic, and inhibition of drug resistance [5]. Cancer researchers have explored the potential use of substances derived from sea cucumbers as anticancer, which are A1 (HA1) and 24-dehydroechinoside A (DHEA), colochiroside A, cucumarioside A2-2, ds-echinoside A, echinoside A, frondanol A5, frondoside A, glycosides 1 and 2, holothurin A, holothurin B, intercedensides A (1), B (2), and C (3), philinopside A, philinopside E, saponin, scabraside D, sphingoid bases, stichoposide C, and stichoposide D [4,5].

More than 350 species of sea cucumbers were collected and identified from Indonesia ocean, and even new species are still being discovered in eastern Indonesia [6]. Indonesia is the major exporter of sea cucumbers to supply the oriental market of sea cucumbers worldwide [7]. Based on that fact, the authors want to explore Indonesia's natural wealth by studying bioactive compounds from sea cucumber *Holothuria scabra* and their anticancer mechanism in cells.

## EXPERIMENTAL DETAILS

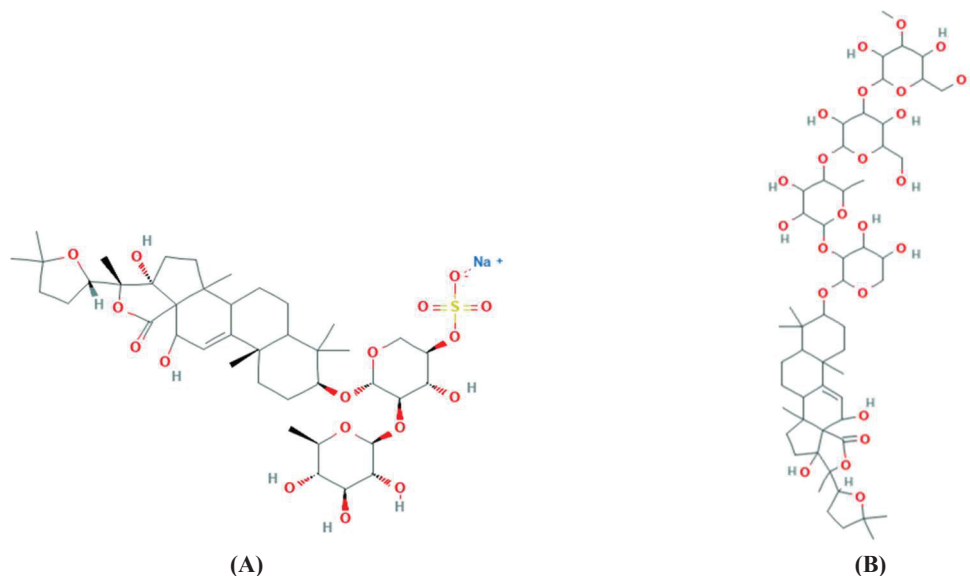
*H. scabra* were collected from South Malang sea, East Java, Indonesia. Sea cucumber active compound extraction was done by soaking sea cucumber slices in methanol overnight, then was filtered, and methanol evaporated with a rotary evaporator. Then, the active compound content from *H. scabra* extract was analyzed using liquid chromatography-mass spectrometry (LC-MS).

The active compounds were predicted based on mass and molecular formula from the LC-MS software. The target proteins of the active compounds were predicted by using Swiss Target Prediction (<http://www.swisstargetprediction.ch>). The compound's properties were examined by using Swiss ADME (<http://www.swissadme.ch>).

The functions of target proteins on cancer-related pathways were identified using The Biological General Repository for Interaction Datasets (BioGRID, <https://thebiogrid.org>). BioGRID is an open access repository consist of a database of protein, genetic, and chemical interactions in humans and significant model organisms [8]. Protein-protein interaction networks were identified using a Search Tool for the Retrieval of Interacting Genes/Proteins (STRING, <https://string-db.org/>) [9]. Mapping of protein in a particular pathway was conducted based on the biological process database on Kyoto Encyclopedia Gene and Genome (KEGG) [10].

## RESULTS AND DISCUSSION

The analysis result of active compound content from *H. scabra* extracts using liquid chromatography-mass spectrometry (LC-MS) is shown in Tabel 1. The analysis result shown that the extract has three main components, namely holothurin A, holothurin B, and holothurin B3. The structures of the holothurians were retrieved from Pubchem, and their drug-likeness properties, which are predicted using Swiss ADME indicated that the compounds have potential as drug profiles (Fig. 1). Both compounds, holothurin A and holothurin B have good solubility, can not penetrate the blood-brain barrier, do not inhibit cytochrome, which is thought to be potential and safe drugs.



Molecule	TPSA	MLOGP	BBB permeant	CYP1A2 inhibitor	CYP2C19 inhibitor	CYP2C9 inhibitor	CYP2D6 inhibitor	CYP3A4 inhibitor	log Kp (cm/s)
Holothurin A	268.64	-0.39	No	No	No	No	No	No	-11.37
Holothurin B	361.36	-4.33	No	No	No	No	No	No	-14.42

(C)

**FIGURE 1.** The structure and characteristics of holothurin A (a) and holothurin B (b) show that both compounds have good solubility, can not penetrate the blood-brain barrier, do not inhibit cytochrome (c)

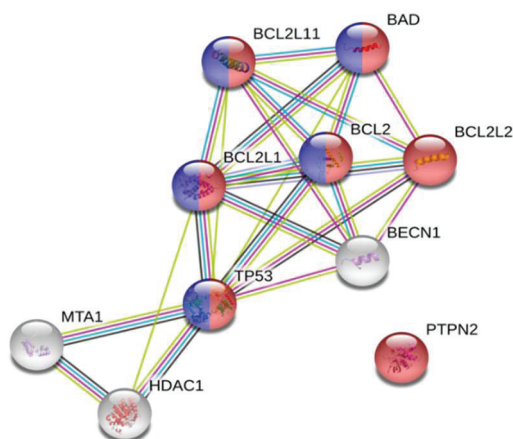
Holothurin is the first anticancer compound of sea cucumber glycoside that was studied by Nigrelli from *Actinopyga agassizi* [11]. Holothurin, A isolated from the sea cucumber *Holothuria fuscocinerea*, showed in vitro cytotoxicity against human promyelocytic leukemia cell line (HL-60) and human hepatoma cell line (BEL-7402) [12]. A study by Wang et al. found holothurin A and holothurin B (from *Holothuria scabra*) cytotoxic activities towards human cervical cancer cell line (HeLa), human hepatoma cell line (HepG2), and human leukemia cell line (K562) which were measured using MTT assay [13]. Yu *et al.* explored bioactive sulfated saponins from *Holothuria moebii* and revealed that holothurin A and holothurin B had potent dose-dependent inhibiting activity on the proliferation of rat glioma cell line (C6), and human glioma cell lines (U87-MG, U251, and SHG-44)[14].

**TABLE 1.** Important active compounds of *H. scabra* methanolic extract

No	Name	Amount (%)	Similarity (%)
1	Holothurin A	6.01	92
2	Holothurin B	5.41	92
3	Holothurin B3	6.07	92

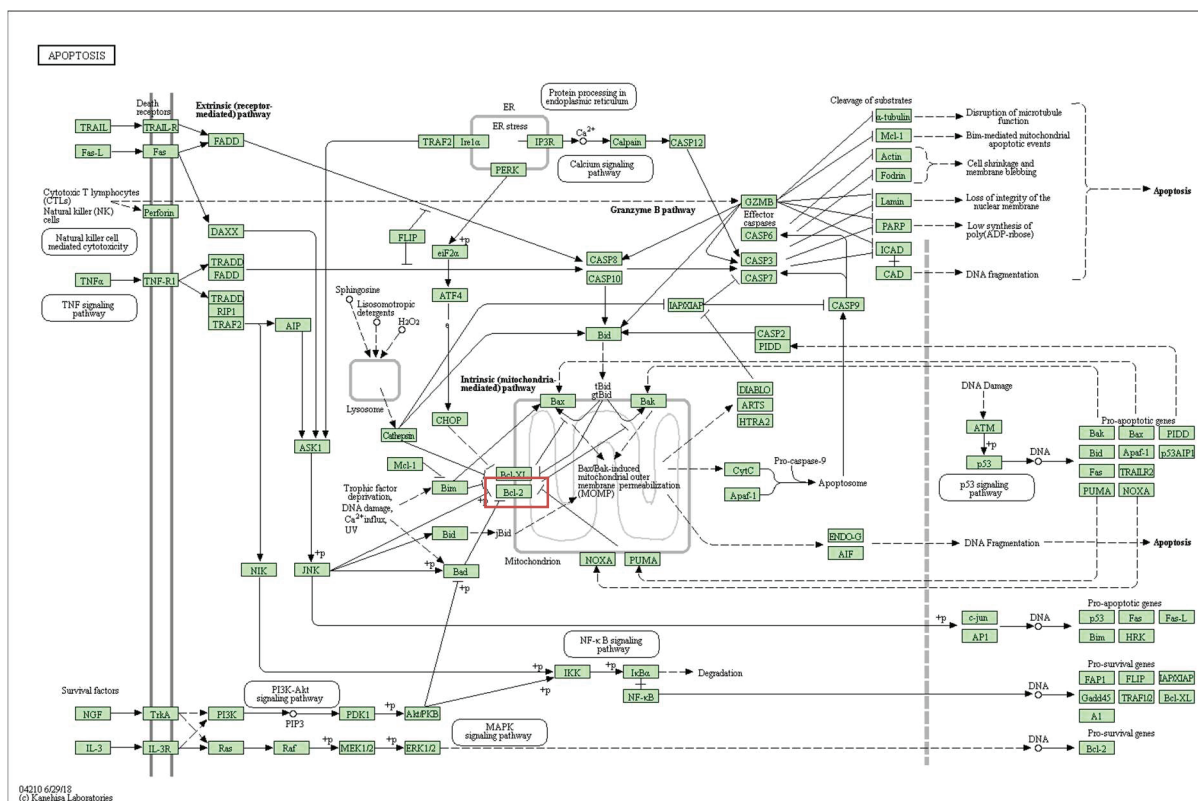
In silico analysis gave information about the structure and characteristics of holothurin A and holothurin B that might have targeted some protein. Antiapoptosis protein BCL2, BCL2L1, and BCL2L2 are targets of holothurin A, whereas holothurin B might interact with HDAC1 and PTPN2. Further analysis using BioGRID and STRING revealed the targeted proteins develop a network that may have a role in the pathomechanism of cancer (Fig. 2). This analysis is essential to revealed functions of proteins that interact with holothurin A and B. Mapping of the BCL2 protein, which is the target of holothurin in the apoptotic pathway, is shown in Fig.3.

Compound–protein interactions are crucial to the discovery of new drugs by screening a candidate compound. The *H. scabra* seems two active compounds, holothurin A and holothurin B, that might have activity as anticancer by targeting BCL2, HDAC1, and PTPN2. The BCL2 inhibits apoptosis by increasing the time-to-death and inherent cell-to-cell variations in the mitochondrial pathway of cell death.[15] HDAC1 has functions in cell cycle regulation and hematopoiesis.[16] Tyrosine-protein phosphatase non-receptor type 2 (PTPN2) is a member of the protein tyrosine phosphatase (PTP) family. The PTP family regulates a variety of cellular processes, including cell growth, differentiation, mitotic cycle, and oncogenic transformation. PTPN2 modulates pancreatic  $\beta$ -cell apoptosis, so that becomes a candidate gene for type 1 diabetes. A study by Kleppe et al. revealed that PTPN2 has a role as a tumor suppressor repressing the proliferation of T cells in T-cell malignancies.[17] Taken together, the study suggested that the *H. scabra* may contain anticancer substances that warrant for candidates of cancer agent sources.



No	Compound	Predicted of Gene Target		
1	Holothurin A	BCL2	BCL2L1	BCL2L2
2	Holothurin B	PTPN2	HDAC1	

**FIGURE 2.** Holothurin A and holothurin B are predicted to have target proteins that play a role in the regulation of intrinsic apoptotic signaling pathway (red) and apoptosis pathway (blue)



**FIGURE 3.** The position of the BCL2 protein, which is the target of holothurin in the apoptotic pathway. The pathway was adopted from KEGG Database.

### SUMMARY

The methanol extract of *H. scabra* isolated from Malang coastal contains three types of anticancer compounds, namely holothurin A, holothurin B, and holothurin B3. The holothurin compounds might have proteins target, namely BCL2, HDAC1, and PTPN2, which play an essential role in the process of apoptosis, cell cycle, and suppressing tumor. The results of this study show that sea cucumbers might have the potential for further research for developing anticancer.

### ACKNOWLEDGMENTS

The work was supported by the Ministry of Research, Technology, and Higher Education of the Republic of Indonesia with Grant Number: 226/SP2H/LT/DRPM/2019.

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